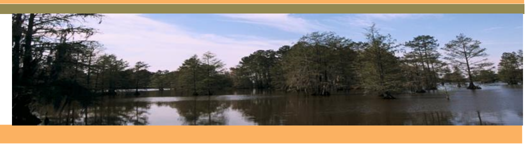
GEORGIA
WATER PLANNING

Regional Water Plan

UPPER FLINT

DRAFT – MARCH 2023



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Executive Summary

Upper Flint Regional Water Plan

This document is the revised Regional Water Plan of the Upper Flint Water Planning Council (the Council). The original Regional Water Plan of the Council was adopted in 2011. This updated plan was adopted in 2023. This Plan was developed by the Council and approved by the Georgia Environmental Protection Division (EPD). The Plan provides a roadmap to guide long-term use of this water planning region's water resources and is to be implemented by water users in the region along with state agencies and other partners. It will also help guide state agency decisions on water permitting and grants and loans for regional water and wastewater-related projects.

Regional Water Plans in Georgia are developed in accordance with the Georgia Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the General Assembly in January 2008. The State Water Plan establishes ten water planning regions across the State, each guided by a regional water planning council, except for the Metropolitan North Georgia Water Planning District, which has a separate water planning process created by the Metropolitan North Georgia Water Planning District Act of 2001.

Upper Flint Regional Water Planning Council, December 2022

The State Water Plan calls for the preparation of Regional Water Plans designed to manage water resources in a sustainable manner. This plan has a planning horizon that forecasts conditions to 2060. It provides a framework for regional planning consistent with the following policy statement:

> *Georgia manages water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens.*

The Upper Flint Water Planning Council is charged with developing this Regional Water Plan. The Council includes up to 30 members from throughout the water planning region, which includes 13 counties and 48 towns and cities. Members are appointed by the Governor, the Lieutenant Governor, and the Speaker of the House. The Council has been active since 2009, when it initiated the development of the first version of this Plan. This plan reflects the revisions from the second update to the plan. The Council completed review and revision of this Plan from 2021 to 2023.

Vision and Goals

The Upper Flint Water Planning Council adopted the following statement to describe its vision for the future of this water planning region's water resources:

The Upper Flint Water Planning Council's purpose is to provide guidance, leadership and education on water resource utilization within the region. Through cooperation among stakeholders, implementation of the Council's plan will support sustainable management of the region's water resources, benefit public health and natural ecosystems, support the State's economy, and enhance the quality of life for its citizens.

The following are the Council's goals, as revised and approved by the Council in 2022:

1. Lead the development and implementation of water resource policy in this region and work together with the state and federal government and with the other regional water planning councils to ensure that the welfare and needs of our region are met.
2. Enhance public understanding of water resources and opportunities for input into regional water policy.
3. Maintain and strive to improve the resilience and sustainability of our water resources to protect natural ecosystems and public health.
4. Sustain water resources through the three "C's" – conserving, capturing, and controlling water – to support the needs of all water users in the region (agriculture, utilities, residential, commercial, industry, forestry, and recreation).
5. Sustain the region's aquifers and surface waters and support the economic activities of the Upper Flint Water Planning Region and the economy of the State of Georgia.

6. Ensure that actions taken by this Council support agriculture and forestry-based economy of this region.

The regional vision and goals were used by the Council to guide the development of this Plan.

Planning Process

The Upper Flint Water Planning Council has been active since 2009. It developed its original regional water plan between 2009 and 2011. The Council completed its first update of the regional water plan in 2017, and this document reflects the second review and revision of this plan, completed in 2023. In between planning periods, the Council focuses on implementation of the plan and information-gathering to support future plan updates. The Council conducted its review and revision of this Plan between 2021 and 2023. During this time, Council members participated in Council meetings, committee work and teleconferences, and joint council meetings to review and revise this Plan. The Council gathers information from a variety of sources to provide a foundation for sound decision-making. Sometimes, the Council finds challenges or significant uncertainties that affected its ability to plan. The Council proceeds based on the best information available and makes recommendations to address information gaps and improve water planning and policies.

Since its inception, the Lower Flint-Ochlockonee Water Planning Council has sought input from a variety of stakeholders and implemented a public participation plan that provides opportunities for public input into the Council's planning process. The Council has interacted with state and federal agencies and local governments from throughout the region, and it has also coordinated with neighboring regional water councils, especially the Middle Chattahoochee and the Upper Flint Water Planning Councils and the Metropolitan North Georgia Water Planning District. The Council uses a consensus-oriented approach in its decision-making.

Upper Flint Water Planning Region

Most of the Upper Flint Water Planning Region is located in the Apalachicola-Chattahoochee-Flint (ACF) River Basin. Small areas of the region are located in the Ocmulgee and Suwannee River Basins. This water planning region is bisected by the fall line dividing the Piedmont and the Coastal Plain. The region is largely rural, with 25% of the total land area in row crops and pasture and an additional 46% in forest. Urban land area cover has increased in recent years, and it now accounts for 6% of the region.

Water Use in the Region

Current water use in the Upper Flint Water Planning Region is approximately 250 million gallons per day (mgd). Water use in the region is projected to increase to 331 mgd in 2060. Agriculture water use accounts for the largest proportion of 2020 water use by a significant margin, and it is expected to remain the largest water use in this planning region. Wastewater flows in the region are currently approximately 35 mgd and expected to increase to 36 mgd in 2060. More than half of the wastewater in the region is discharged through point sources.

Water Resource Assessments

To support the regional water planning process, EPD developed resource assessment models for surface water availability, groundwater availability, and water quality. The purpose of the resource assessments is to estimate the capacity of streams and aquifers to meet water consumption demands and the capacity of streams to meet wastewater discharge demands, within thresholds that indicate the potential for local or regional impacts. The resource assessments are modeling exercises that use several conservative assumptions. Results of the assessment models were compared against estimates of current and projected water use and wastewater flows. The assessment models identified potential challenges in the capacity of water resources to meet water supply and wastewater demands, within thresholds EPD selected to indicate potential local or regional impacts. The Upper Flint Water Planning Council considered the assessment model results, this water planning region's water needs, and potential impacts on the water planning region, both environmental and economic. The Council developed the rest of this plan to address challenges identified by the models and meet the Council's vision and goals for this water planning region. The results of the assessments and the Council's approach to addressing the results are summarized in Table ES-1.

Table ES-1: Resource Assessment Results – Upper Flint Water Planning Region		
Resource Assessment	**Summary of Model Results**	**Council Plan to Address Results**
Surface Water Availability	The surface water availability assessment model identified moderate water supply and wastewater assimilation challenges under current use and forecasted 2060 demands in surface water availability in the Upper Flint region. The results indicated seven facilities with water supply challenges and ten facilities with wastewater assimilation challenges. The Council also reviewed streamflow results under current use and future demand scenarios at Carsonville on the Flint River.	Address streamflow challenges with demand management, supply management, flow augmentation, and drought response practices in the region. Challenges at specific facilities will be addressed by GAEPD in the permitting process. Address flow challenges specific to protected aquatic species with a habitat conservation plan. Better information to support more thorough evaluation of resource capacity will continue to improve our ability to manage surface water availability effectively and sustainably in this region.
Groundwater Availability	For groundwater, current use and forecasted 2060 demands for the Claiborne Aquifer are below the sustainable yield (low-end). For the Cretaceous Aquifer, current use and forecasted 2060 demands are within the sustainable yield range (between low-end and high-end) in a focused assessment of the aquifer within the Upper Flint Region. In the Floridan Aquifer, current use and forecasted 2060 demand is above the high end of the sustainable yield range. As noted in the discussion in this section, the Dougherty Plain results reflect impacts of groundwater use on streamflow and not direct impacts on aquifer health.	Increased use of the Claiborne and Cretaceous Aquifers should be monitored develop appropriate management strategies that address geographic and time-based variations in capacity and demands. In the Upper Floridan Aquifer in the Dougherty Plain, the impact of groundwater withdrawals on surface water flows in the Flint River Basin should continue to be a determining factor in guiding the location and amount of groundwater use from this aquifer. Moreover, since 2012, there has been a moratorium on new and expanded withdrawals from the Floridan Aquifer in the Dougherty Plain. Better and more geographically specific information on groundwater resource capacity will improve our ability to evaluate aquifer use and management practices.

Surface Water Quality	Water quality model results indicated overall increasing availability of assimilative capacity in streams in the Flint River Basin due to assumed more stringent permit conditions where discharges increase in the future. However, some areas continue to model limited or exceeded availability of assimilative capacity under future conditions despite stringent permit conditions.	Implement practices targeted especially toward nonpoint source of pollutants to improve assimilative capacity and to reduce nutrient loading in the region's streams and lakes. It is expected that GAEPD will adjust point source discharge permit limits over time as needed to address assimilative capacity constraints and nutrient criteria. More nonpoint source controls may be needed to address nutrient criteria. Collect more complete information to support the targeting of management practices for water quality in the future.

Recommended Management Practices

The Upper Flint Water Planning Council developed a set of eighteen management practices, including seven Demand Management practices, four Supply Management and Flow Augmentation practices, two Returns Management practice, and five Water Quality practices. From this set, the Council selected three [*To be updated at March Council meeting]* high priority management practices, which are highlighted in the box to the right.

For each management practice, this Plan describes implementation steps, responsible parties, implementation schedules, cost estimates, and funding sources. The Plan also identifies benchmarks by which implementation can be evaluated.

High Priority Management Practices

- *Evaluate storage options in the Upper Flint Water Planning Region that can provide for supply and flow augmentation in dry periods*
- *Continue to improve the agricultural water withdrawal metering program*
- *Increase education directed toward improving water quality*

Other Recommendations from the Upper Flint Water Planning Council

This Regional Water Plan includes recommendations to the State and other entities to address information needs and water policy issues. The Upper Flint Water Planning Council emphasizes the need for information to support better water planning in the future. The Council believes that water planning should be based on data reflecting actual water use and conditions as much as possible. The Council seeks several improvements in the water resource assessments to support improved planning. It also recommends more detailed evaluation of some of its current management practices and study of potential future management practices. With respect to water policy, the Council urges the Georgia General Assembly to provide funding to continue the work of the regional water planning councils in the future. It requests that the Georgia General Assembly and implementing agencies explore all possible funding sources to support implementation of this Plan. The Council also makes specific recommendations concerning drought management, conservation requirement implementation, interbasin transfers, and coordination with other regional water councils and the Metropolitan North Georgia Water Planning District.

The Upper Flint Water Planning Council coordinated closely with neighboring water planning councils and developed a set of joint recommendations with the Middle Chattahoochee and Lower Flint-Ochlockonee Water Planning Councils to address shared concerns in the Apalachicola-Chattahoochee-Flint System. These joint recommendations emphasize the need for more water storage capacity and more effective use of existing storage capacity in the ACF, continued improvement of the information base for water planning and management, and consideration of a new organization for coordinated interstate planning in the ACF.

SUMMARY: The regional water planning process in Georgia was established by the State Water Plan. The Upper Flint Water Planning Council's vision and goals guided the Council in the development of this Regional Water Plan.

Section 1. Introduction

1.1 The Significance of Water Resources in Georgia

Of all Georgia's natural resources, none is more important to the future of our state than water. The wise use and management of water is critical to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens.

Georgia has abundant water resources, with fourteen major river systems (see Figure 1-1) and multiple groundwater aquifer systems. These waters are shared natural resources. Streams and rivers run through many political jurisdictions. The rain that falls in one part of Georgia may replenish the aquifers used by communities many miles away. While water in Georgia is abundant, it is not an unlimited resource. It must be carefully managed to meet long-term water needs.

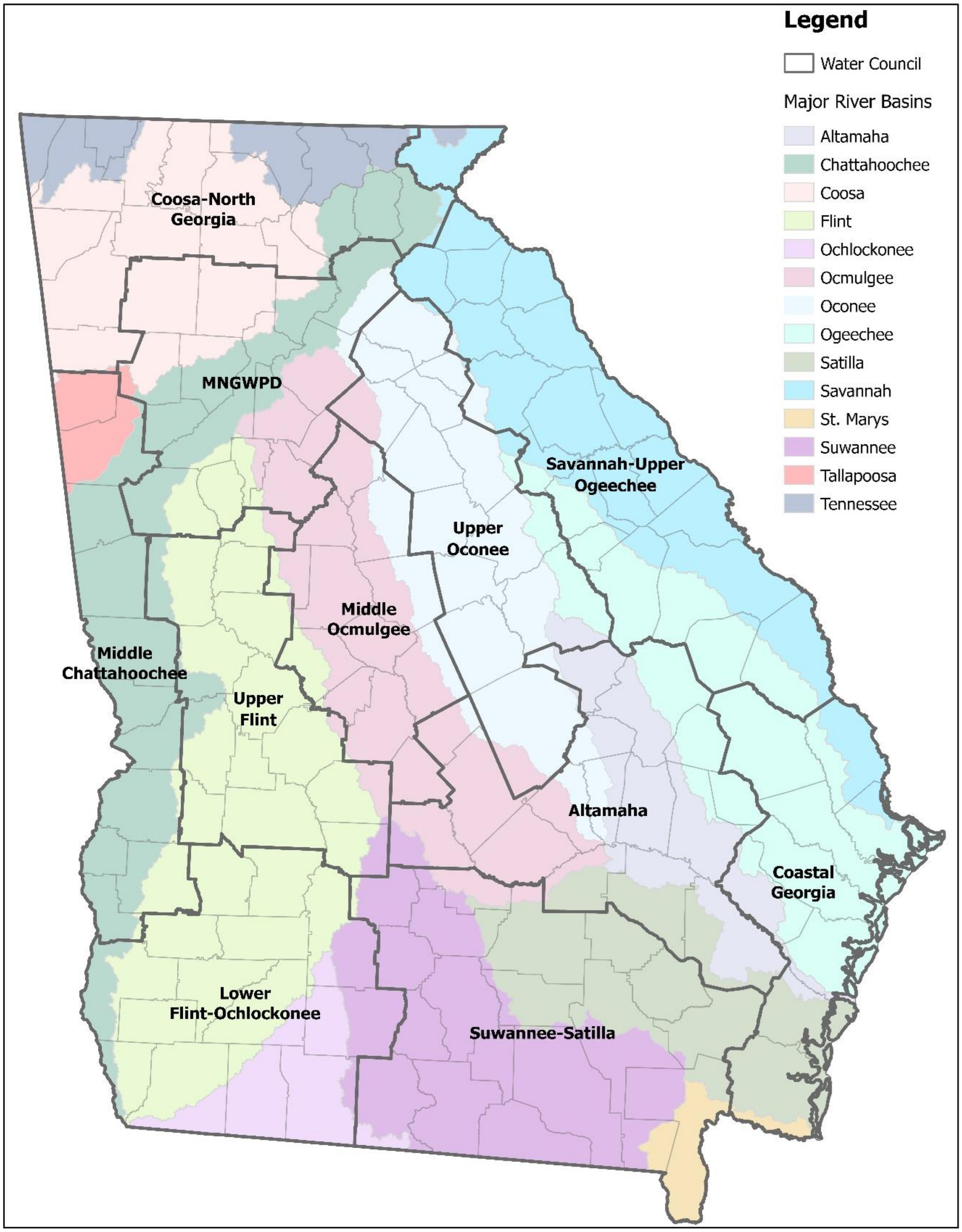
Since water resources, their conditions, and their uses vary greatly across the State, selection and implementation of management practices on the regional and local levels are the most effective way to ensure that current and future needs for water supply and assimilative capacity are met.

Therefore, the Georgia Comprehensive State-wide Water Management Plan (State Water Plan) calls for the preparation of regional water development and conservation plans (Regional Water Plans) for the ten water planning regions depicted in Figure 1-1, not including the District, which has a separate water planning process created by the Metropolitan North Georgia Water Planning District Act of 2001. The District's planning process is aligned with those of the ten regional water planning councils, so the District and neighboring councils work together to coordinate on planning for shared water resources.[1]

This Regional Water Plan (this Plan) was prepared for the Upper Flint Water Planning Region by the Upper Flint Water Planning Council (the Council). It describes the regionally appropriate water management practices to be employed in Georgia's Upper Flint Water Planning Region over the next several decades.

[1]Regional Water Plans and supporting information about the regional water planning councils can be found on the Georgia regional water planning website: https://waterplanning.georgia.gov/. This website includes information about the Metropolitan North Georgia Water Planning District. The full website for the District includes the District's plan and supporting materials: http://www.northgeorgiawater.org/.

Figure 1-1: River Basins and Water Planning Regions of Georgia



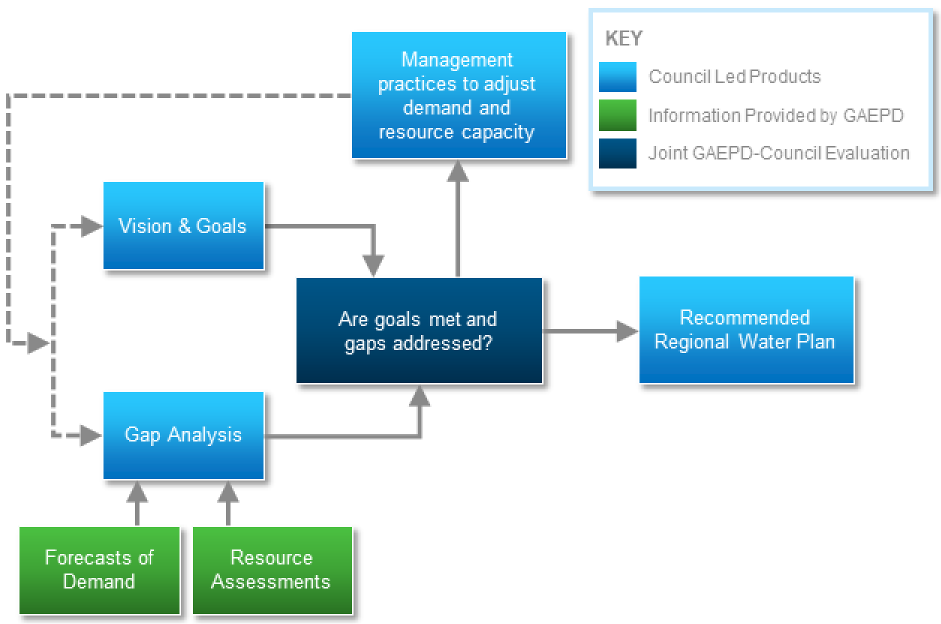
1.2 State and Regional Water Planning Process

The State Water Plan calls for the preparation of Regional Water Plans designed to manage water resources in a sustainable manner through 2050. It establishes ten regional water planning councils and provides a framework for regional planning consistent with the following policy statement:

> *Georgia manages water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens.*

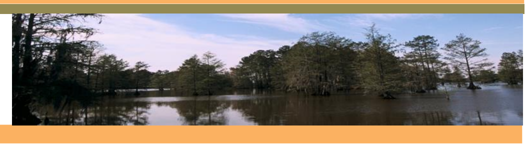
This Regional Water Plan has been prepared following the consensus-based planning process illustrated in Figure 1-2. As detailed in the Upper Flint Water Planning Council's Memorandum of Understanding with the Georgia Environmental Protection Division (GAEPD) and the Department of Community Affairs (DCA), the planning process required and benefited from the input of local governments, other regional water planning councils, and the public.[2]

Figure 1-2: Water Planning Process



The Upper Flint Water Planning Council initiated its work in 2009. The Council meets regularly to consider water resource related information and activities in the region.[3] The Council adopted its first Regional Water Plan in 2011 after a public review period and approval by GAEPD. Since t

[2] The Upper Flint Water Planning Council's Memorandum of Agreement, updated in 2016, can be found on the Council's website: https://waterplanning.georgia.gov/water-planning-regions/upper-flint-water-planning-region/upper-flint-council
[3] Meeting summaries for the Middle Chattahoochee Water Planning Council meetings are available on the Council's website: https://waterplanning.georgia.gov/water-planning-regions/upper-flint-water-planning-region



hat time, the Council has conducted two cycles of review and revision to the regional water plan in 2016-2017 and 2021-2023. Revised plans were adopted in June 2017 and June 2023, after a public review period and approval by GAEPD. This version of the document reflects the revised plan adopted in June 2023.

1.3 The Upper Flint Water Planning Council's Vision and Goals

In 2009, the Upper Flint Water Planning Council developed a vision statement to describe its desired outcomes for the water planning region's future and adopted goals that supported that vision. In 2016, and again in 2022, the Council reviewed and updated its vision and goals. The Council adopted revisions to the vision statement in 2017 and revisions to the goals in 2022.

The following is the Council's vision statement, as reaffirmed by the Council in 2022:

> *The Upper Flint Water Planning Council's purpose is to provide guidance, leadership and education on water resource utilization within the region. Through cooperation among stakeholders, implementation of the Council's plan will support sustainable management of the region's water resources, benefit public health and natural ecosystems, support the State's economy, and enhance the quality of life for its citizens.*
>
> The following are the Council's goals, as revised and approved by the Council in 2022:

1. Lead the development and implementation of water resource policy in this region and work together with the state and federal government and with the other regional water planning councils to ensure that the welfare and needs of our region are met.
2. Enhance public understanding of water resources and opportunities for input into regional water policy.
3. Maintain and strive to improve the resilience and sustainability of our water resources to protect natural ecosystems and public health.
4. Sustain water resources through the three "C's" – conserving, capturing, and controlling water – to support the needs of all water users in the region (agriculture, utilities, residential, commercial, industry, forestry, and recreation).
5. Sustain the region's aquifers and surface waters and support the economic activities of the Upper Flint Water Planning Region and the economy of the State of Georgia.
6. Ensure that actions taken by this Council support agriculture and forestry-based economy of this region.

The Upper Flint Water Planning Council's vision and goals were adopted to guide the Council in developing this Plan. The vision and goals describe the Council's priorities and inform Council decision-making in its planning process. The vision and goals were used by the Council to guide the selection of water management practices and recommendations, which are discussed in Section 6.

SUMMARY: The Upper Flint Water Planning Region is largely rural, and agriculture is the largest sector of the economy and the largest water use in this water planning region. State and federal policies are important components of water resource management in this water planning region.

Section 2. The Upper Flint Water Planning Region

2.1 History and Geography

The Upper Flint Water Planning Region (Figure 2-1) encompasses over 4,355 square miles in west-central Georgia and includes 13 counties (Crisp, Dooly, Macon, Marion, Meriwether, Pike, Schley, Spalding, Sumter, Talbot, Taylor, Upson, and Webster), as well as 48 towns and cities partially or wholly within these counties. Major regional river basins include the Flint and Chattahoochee, and small areas of the water planning region are in the Ocmulgee and Suwannee River Basins.

The small cities and towns in the Upper Flint Water Planning Region developed around train depots in the late 19th century. Those cities and towns developed into industrial centers, which have experienced cyclical growth and decline in the past century. From 1985 to 2019, the region experienced an estimated urban land use increase of approximately 5%.[1] This trend signals a greater presence of industrial and commercial development in the region and the influence of growth in the metropolitan Atlanta area. Agriculture is the leading economic sector and water user in this water planning region. Agricultural development in west Georgia expanded in the 19th century with the development of the cotton gin, and major crop diversification began in the 1930's due to farm mechanization advances, New Deal policies, and cotton yield reductions caused by the boll weevil. Widespread use of irrigation in Georgia began to develop in the 1970's.

2.2 Characteristics of this Water Planning Region

The Upper Flint Water Planning Region is largely rural, with 25% of the total land area in row crops and pasture and an additional 46% in forest. As noted above, urban land area cover has increased in recent years, and it now accounts for 6% of the water planning region. Land cover in this water planning region, based on data derived from the 2019 National Land Cover Data, is illustrated in Figure 2-2.

[1] National Land Cover Database, 2019

Figure 2-1: Upper Flint Water Planning Region

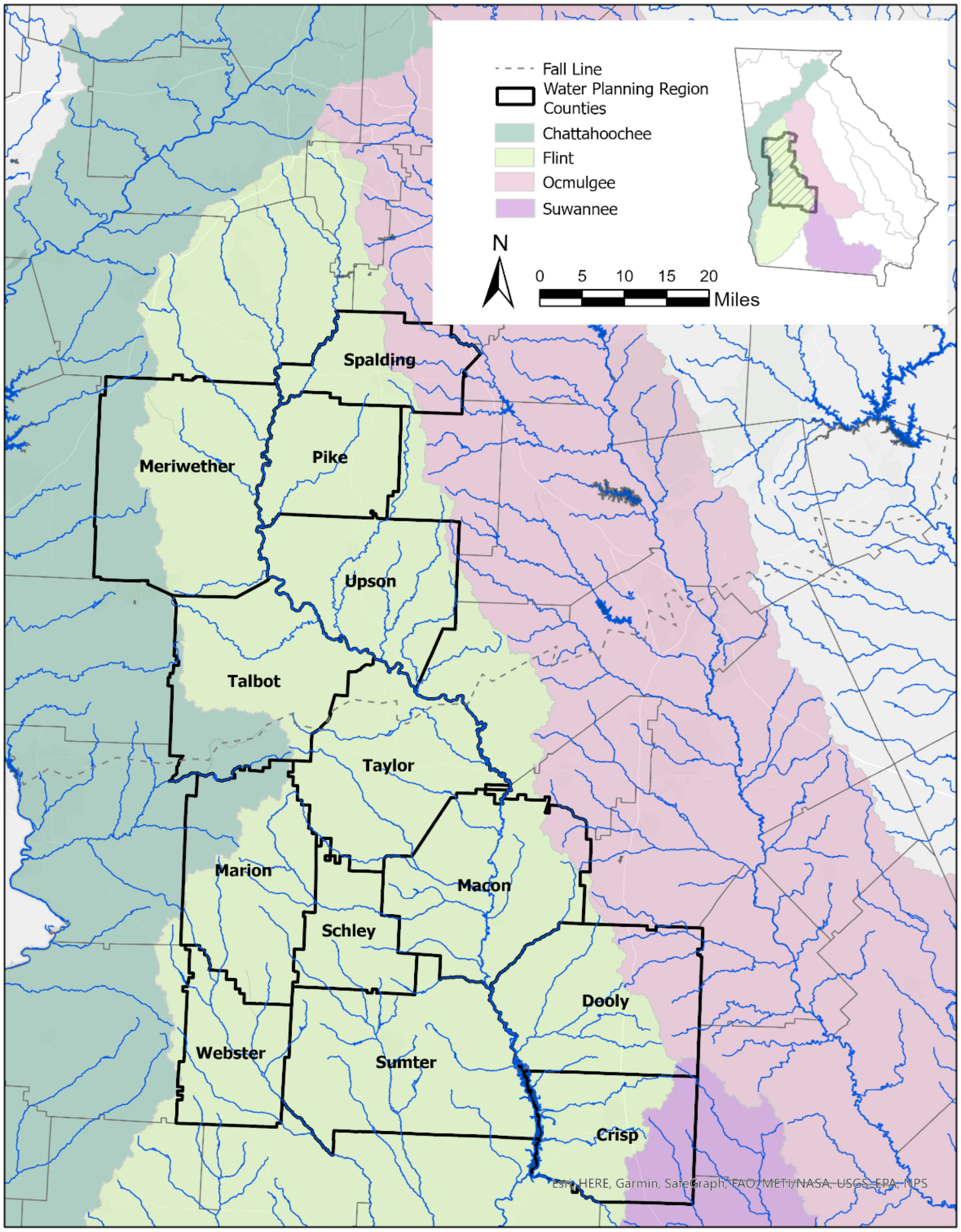
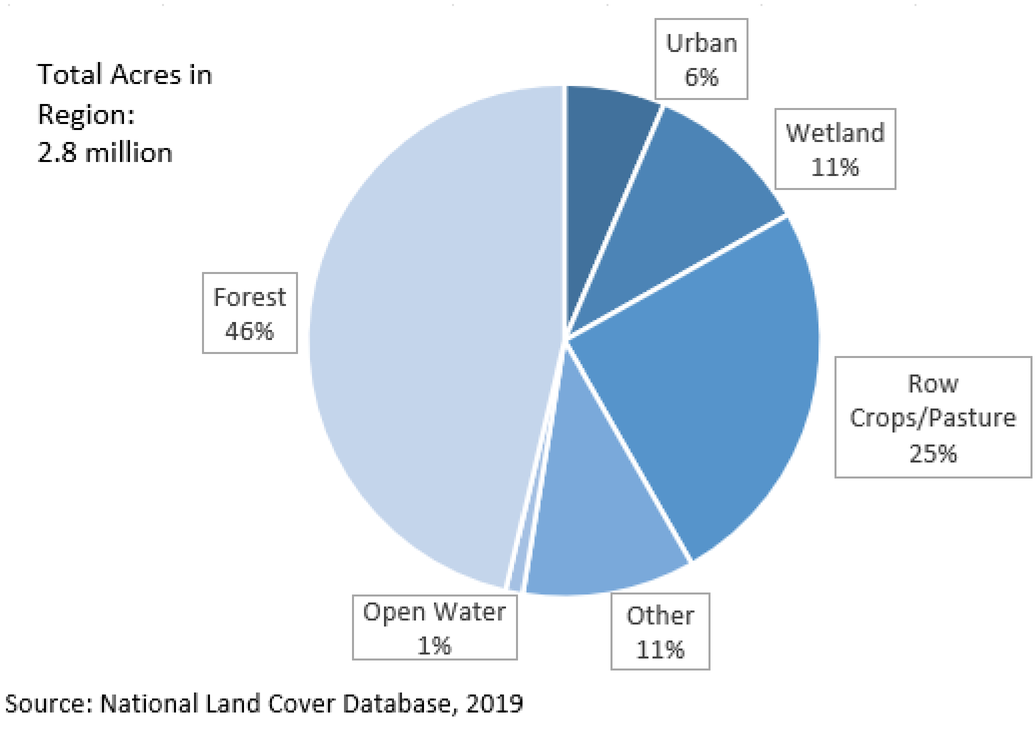


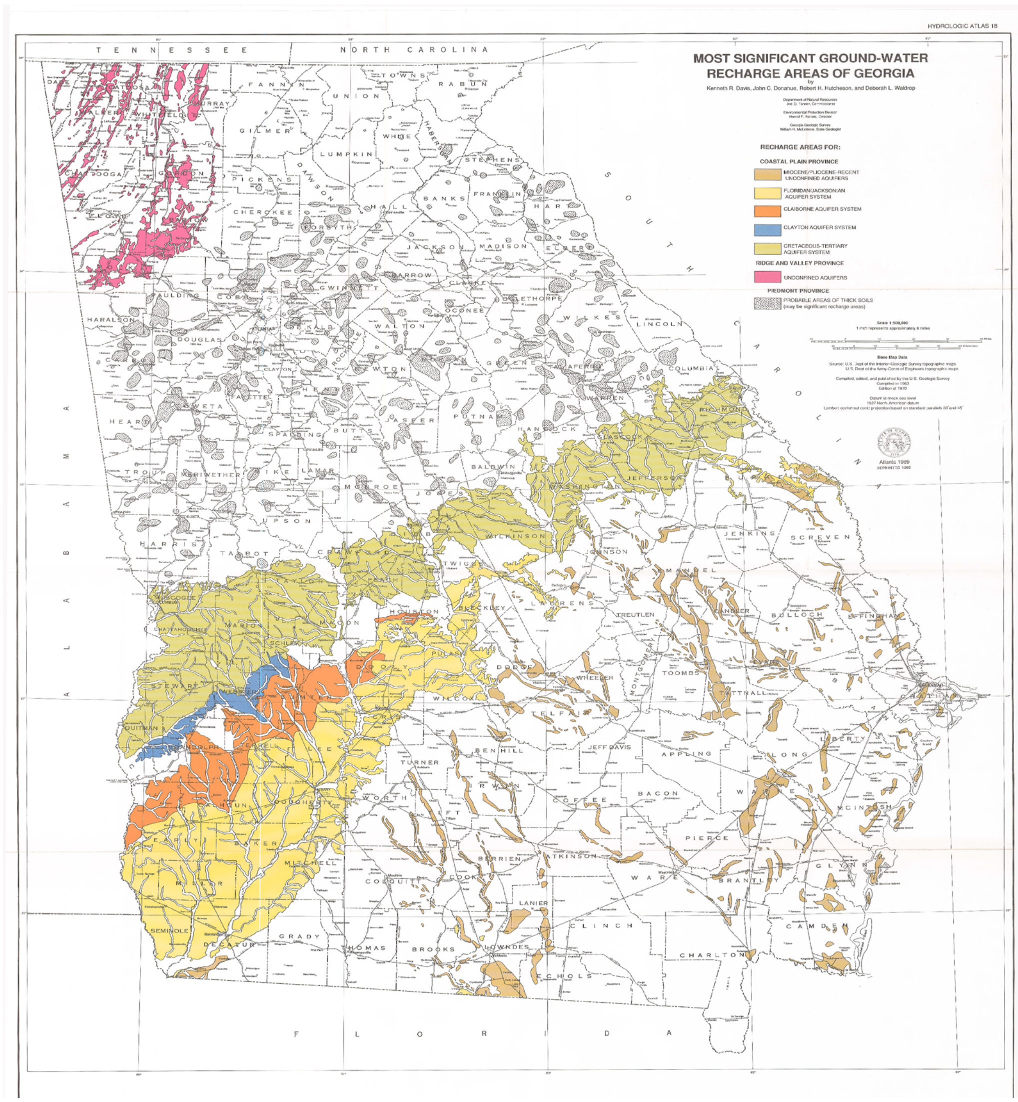
Figure 2-2: Upper Flint Water Planning Region Land Cover, 2019



Natural features in the Upper Flint Water Planning Region provide habitat for an abundance of flora and fauna as well as areas critical for recharging the region's aquifers (see Figure 2-3 for a map of recharge areas in Georgia). This water planning region is bisected by the fall line dividing the Piedmont and the Coastal Plain. At the fall line, metamorphic rock and clayey soils give way to sedimentary rock and sandy soils. The Coastal Plain physiographic region, south of the fall line "is underlain by relatively soft, weakly consolidated rocks and unconsolidated sediments deposited by the sea or streams when the shoreline was at or near the fall line between 80 and 100 million years ago."[2] Aquifers in this water planning region include the Crystalline Rock aquifers in the Piedmont and the Cretaceous, Clayton, Claiborne, and Floridan aquifer systems in the Coastal Plain.

[2] EPD, *Flint River Basin Regional Water Development and Conservation Plan*, 2006: https://epd.georgia.gov/georgia-river-basin-management-planning/georgia-flint-river-basin-plan.

Figure 2-3: Aquifer Recharge Areas in Georgia



Source: Most Significant Ground-Water Recharge Areas of Georgia, Hydrologic Atlas 18, Kenneth R. Davis, 1992

2.3 Policy Context for this Regional Water Plan

The Upper Flint Water Planning Region is subject to several overlapping layers of water resource management by state and federal agencies. State permitting programs for water withdrawals and wastewater dischargers affect all water users (OCGA §§12-5-32, 12-5-30(a), 12-5-30(b), 12-5-96, 12-5-105; Georgia Department of Natural Resources (DNR) Rules 391-3-6-

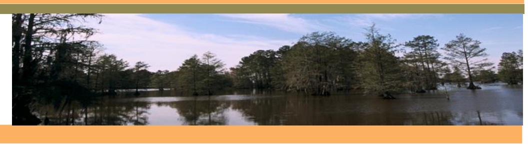
.06, 391-3-6-.07, 391-3-2-.03). In this region, the following laws, regulations, and related issues are also directly relevant to water management:

- The Flint River Water Development and Conservation Plan of 2006 serves as guidance for the Georgia Environmental Protection Division for agricultural water use permit issuance in the Flint River Basin. The 2006 Flint River Water Development and Conservation Plan was developed under the authority of the Water Quality Act (OCGA §12-5-31(h)) and Groundwater Use Act (OCGA §12-5-96(e)) in response to a prolonged drought, increased agricultural irrigation in southwest Georgia since the 1970's, and scientific studies that predicted severe impacts on streamflow in the Flint River Basin due to withdrawals from area streams and the Floridan Aquifer. The Upper Flint Regional Water Plan builds on the existing 2006 plan for the Flint River Basin. The 2006 plan provides both a scientific and policy foundation for water resources planning in the Flint River Basin, and this Plan will be implemented in concert with it.[3]
- The Flint River Drought Protection Act (OCGA §12-5-540) and its implementing rules (DNR Rule 391-3-28) provide for demand management through agricultural irrigation suspension in times of drought. The Act was amended in 2014. Among other things, the amended law set requirements for agricultural irrigation efficiency (OCGA § 12-5-546.1).
- Federal Energy Regulatory Commission (FERC) licensing requirements for privately-owned hydroelectric impoundments apply to Lake Blackshear in the Upper Flint Water Planning Region.
- The Florida Department of Environmental Protection (FDEP), with approval from the Environmental Protection Agency, adopted new nutrient criteria for free-flowing streams and lakes in Florida in 2013. These criteria may impact water quality management in this water planning region and other water planning regions with river systems that cross into Florida.[4] At this time, Georgia is monitoring water quality and focused on the development of a nutrient strategy that is likely to include point source discharge limits and nonpoint source management to address these criteria.
- Under the federal Endangered Species Act, four species of freshwater mussels have been listed as endangered or threatened in the Upper Flint Water Planning Region (see Table 2-1). Additionally, the Gulf sturgeon is listed as threatened, and flow requirements for the Gulf sturgeon affect the management of the Apalachicola-Chattahoochee-Flint System as a whole. The Endangered Species Act prohibits takings of these species and sets requirements for protection of their critical habitats.[5]
- The U.S. Army Corps of Engineers (USACE) operates five federal reservoir projects on the Chattahoochee River (Lake Sidney Lanier, West Point Lake, Walter F. George Lake, George W. Andrews Lake, and Lake Seminole). The operation of these projects affects

[3] EPD, *Flint River Basin Regional Water Development and Conservation Plan*, 2006: https://epd.georgia.gov/georgia-river-basin-management-planning/georgia-flint-river-basin-plan.

[4] More information on Florida's nutrient criteria is available online: https://floridadep.gov/dear/water-quality-standards/content/numeric-nutrient-criteria-development

[5] More information about Gulf sturgeon (*Acipenser oxyrinchus)* is available from the US Fish and Wildlife Service: https://ecos.fws.gov/ecp/species/651



the parts of the Upper Flint Water Planning Region that are within the Chattahoochee Basin, and it also affects the region as a key component of water management in the Apalachicola-Chattahoochee-Flint (ACF) Basin as a whole. On March 30, 2017, an updated Water Control Manual for the ACF was issued by the USACE.[6]

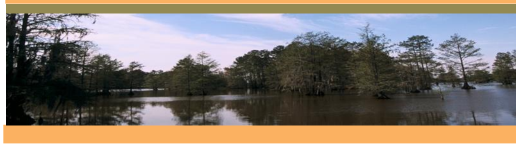
- The ACF Basin has been the subject of protracted litigation over the management and allocation of water resources among Florida, Georgia, and Alabama and other interested parties. In 2013, Florida filed a suit against Georgia in the U.S. Supreme Court in a case of original jurisdiction. Florida asked the court to impose equitable apportionment in the ACF. The US Supreme Court ultimately ruled in Georgia's favor on April 1, 2021, denying Florida's request for equitable apportionment.[7]

Table 2-1: Federally Listed Endangered and Threatened Freshwater Mussels in the Upper Flint Water Planning Region

Common Name	Scientific Name	Status	More Information
Gulf moccasinshell	*Medionidus penicillatus*	Endangered	https://ecos.fws.gov/ecp/species/7663
Shinyrayed pocketbook	*Hamiota subangulata*	Endangered	https://ecos.fws.gov/ecp/species/6517
Oval pigtoe	*Pleurobema pyriforme*	Endangered	https://ecos.fws.gov/ecp/species/4132
Purple bankclimber	*Elliptoideus sloatianus*	Threatened	https://ecos.fws.gov/ecp/species/7660

[6] Information on the updated ACF Master Water Control Manual can be found on the following USACE website: http://www.sam.usace.army.mil/Missions/Planning-Environmental/ACF-Master-Water-Control-Manual-Update/

[7] The decision of the U.S. Supreme Court in this case can be found at this link: https://www.supremecourt.gov/opinions/20pdf/22o142_m648.pdf



*SUMMARY: This section assesses the **current** use, capacity, and condition of water resources in the Upper Flint Water Planning Region.*

Section 3. Current Assessment of Water Resources of the Upper Flint Water Planning Region

3.1 Major Water Uses in this Water Planning Region

Water use and wastewater treatment in the region presented in this plan is generally categorized in four sectors:

- **Municipal** - water withdrawn by public and private water suppliers and delivered for a variety of uses (e.g., residential, commercial, light industrial)
- **Industrial** - water withdrawn for fabrication, processing, washing, and cooling for facilities that manufacture products, including steel, chemical and allied products, paper, and mining
- **Energy** - water withdrawn primarily for cooling purposes in the production of electricity at thermoelectric plants (Hydroelectric energy uses water to produce energy, but because this use is nonconsumptive, hydroelectric water use is not included.)
- **Agriculture** - includes row and orchard crops as well as most vegetable and specialty crops. (Nursery, animal livestock, and golf course irrigation water use estimates are also included.)

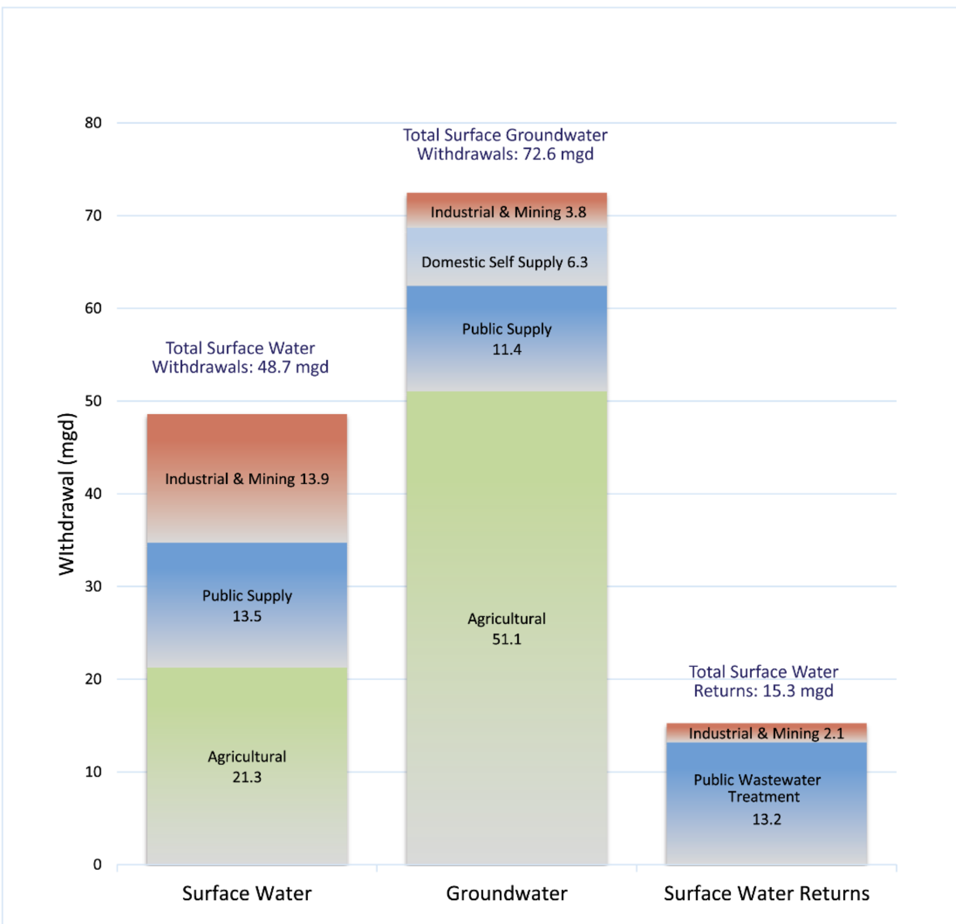
Water use in the region is estimated in a few different ways in this Plan. Section 4 discusses forecasts of water use and wastewater treatment demands in the region from 2020 to 2060 for the above sectors. The 2020 baseline use estimates for the forecasts are frequently cited in this plan in discussions of current use. The methods of estimating 2020 use for the baseline are described in Section 4. In this section, an initial snapshot of current water use in the region is provided based on USGS estimates of water withdrawals and returns for 2015 (Figure 3-1). The USGS data are not as current as the forecast baseline, and the methods of estimation are not the same as those used in the baseline forecasts in Section 4.

The USGS 2015 estimates are reported here because they provide an overview of use in the region that is generally comparable to other regions of the state and the nation. The USGS estimates are generated every five years across the U.S. Figure 3-1 illustrates the USGS estimates of 2015 water withdrawals, by source, as well as the returns to surface water of treated wastewater. This figure illustrates the importance of groundwater as a source of water in the region (accounting for 60% of withdrawals) and the dominance of agriculture in water use in the region (also accounting for 60% of withdrawals).

In Georgia, agricultural water use is monitored through the State Agricultural Water Conservation and Metering Program, which has installed over 17,000 water meters across the state. The USGS estimates of 2015 water use make use of 2015 meter data from this program as a primary source of data for estimating agricultural water use in this region.

This section describes the results of water resources assessments in this region. Each assessment used slightly different estimates of water use, depending on the methods and assumptions for that assessment. While there are differences, most try to assess the region's water resources as a baseline that is close in time to 2020 and a future planning horizon of 2060. The estimates of water use for each assessment are described in the sub-sections that follow.

Figure 3-1: USGS Estimates of Water Withdrawals and Surface Water Returns in the Upper Flint Region, 2015



Source: Painter, J.A., 2019, Estimated use of water in Georgia for 2015 and water-use trends, 1985–2015: U.S. Geological Survey Open-File Report 2019–1086, 216 p., https://doi.org/10.3133/ofr20191086.

When discussing water use in the region, for planning purposes, it is important to understand the amount of water that is returned to the hydrologic system after it is used. Consumptive use is the difference between the total amount of water withdrawn from a defined hydrologic system and the total amount of the withdrawn water that is returned to the same hydrologic system. USGS estimates of surface water returns are included Figure 3-1.

The resource assessments for this Plan are particularly concerned with the amount of water that is returned in a time frame that makes it available to support other uses. Consumptive use can be difficult to measure when returns to instream flows are not through a point source discharge, which can be measured directly. (In Figure 3-1, the surface water returns are made by point source discharges.) As a result, in this planning process, on-site sewage treatment and land application systems are considered to be 100% consumptive. Similarly, agricultural water use for irrigation is considered to be 100% consumptive. These conservative assumptions do not mean that no amount of water returns to the hydrologic system, but for the purposes of the resource assessment, they are treated as 100% consumptive.

3.2 Current Conditions Resource Assessments

GAEPD has developed three resource assessments for the State's water resources: ***surface water availability, groundwater availability,*** **and** ***surface water quality***. These assessments used models to analyze the capacity of streams and aquifers to meet water consumption demands and of streams to meet wastewater discharge assimilation capacity needs within thresholds selected by GAEPD to indicate the potential for local or regional impacts. The assessments were conducted on a resource basis (i.e., river basins and aquifers). The results of these assessments for ***current*** conditions in this water planning region are summarized in this section. Section 5 describes the ***future*** conditions of these resources, as projected by the assessment models. Full details of each resource assessment can be found in the resource assessment reports, which will be available on the water planning website https://waterplanning.georgia.gov/resource-assessments.

3.2.1 Surface Water Availability

The purpose of the surface water availability resource assessment is to model the response of surface water bodies (streams and lakes) to meeting current and forecasted consumptive water demands. In this planning cycle, a new model – the Basin Environmental Assessment Model (BEAM) – was developed for use in planning and permitting. The new model greatly improves our ability to evaluate surface water availability at a high level of resolution. Figure 3-2 is a schematic of the domain for the Apalachicola-Chattahoochee-Flint (ACF) Basin model within the Upper Flint region. Each point in the schematic represents a water resource facility, for which the BEAM model can generate results on surface water availability. In prior planning cycles, model results were only generated at a few nodes in each basin.

Important inputs to the model include water supply demands, treated wastewater returns, reservoir operations, and instream flow requirements. The model was calibrated to stream gage data from the modeled river basins and using estimates of unimpaired flows for the modeling horizon. The unimpaired flow estimates were updated for this assessment.

In this planning cycle, the following baseline scenarios for current conditions were evaluated:

- Baseline: Water demands average for 2010-2018
- Baseline Drought: Water demands for 2011

The 2011 demands reflect water use during an extremely dry year. The Baseline Drought scenario uses water demand data that supports a conservative approach to addressing the availability of resources to meet peak water demands during drought.

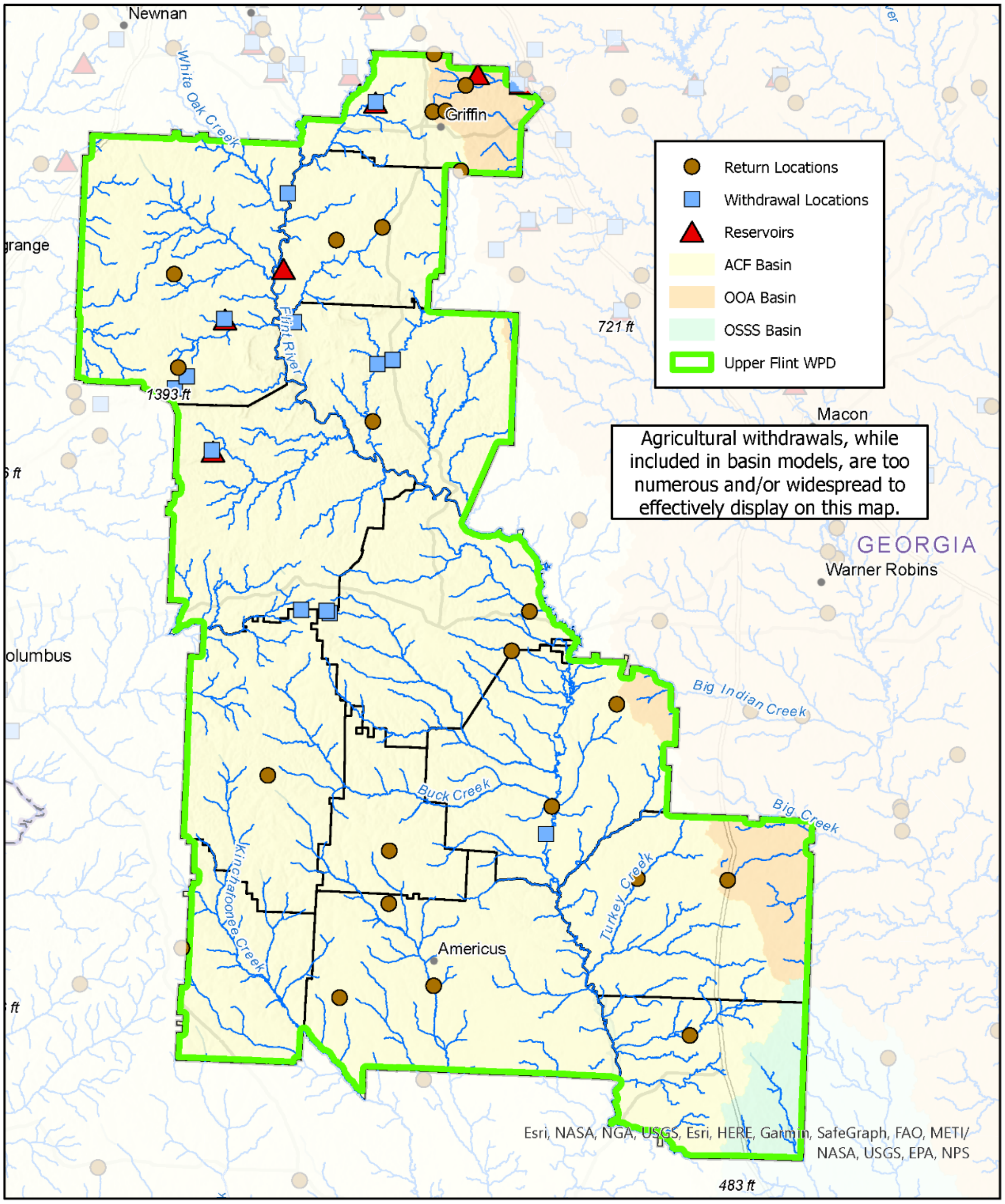
In these scenarios, the same levels of demand (monthly averages) are applied to the whole assessment period. For this assessment the period included 79 years: 1939-2018. This period represents a long range of historical stream flow conditions and a broad range of hydrologic conditions. The assessment incorporated instream flow protection requirements from existing water withdrawal permits.

Reservoir operations data used in the model were from the current Water Control Manual operations for the federal reservoirs. For other reservoirs, the resource assessment incorporates data from reservoir owners if they provided storage and operational data to GAEPD for this purpose. Storage and operational data were not available for Georgia Power reservoirs in the region, and these reservoirs were modeled as run-of-river projects.

For the ACF assessment, the BEAM model included consideration of the impacts of groundwater use in Subarea 4 of the Upper Floridan Aquifer in the Dougherty Plain, where interconnection of the aquifer with the surface water is high. Subarea 4 includes the Flint River Basin south of Dooly County, part of the lower Chattahoochee River Basin, and a narrow strip on the eastern side of the Ochlockonee and Suwannee River Basins. An assessment of the Floridan Aquifer, including a specific assessment of the portion in the Dougherty Plan, is discussed in Section 3.2.2. The surface water results reported here incorporate the modeled impacts of groundwater withdrawals on baseflow to surface water streams.

For the Upper Flint region, GAEPD presented the model results to the Council for the Apalachicola-Chattahoochee-Flint Basins. Consumptive water demands in the scenarios included municipal, industrial, agricultural, and energy (thermoelectric power production) uses.

Figure 3-2: BEAM Model Schematic for the Upper Flint Water Planning Region



The assessment evaluated where water availability challenges were observed in the model results. GAEPD provided an assessment of where, when, and by how much surface water availability could not meet the following needs:

- Available water for a water withdrawal (municipal, industrial, energy)
- Available water to assimilate a wastewater discharge (municipal, industrial) as measured against the low flow used to set the effluent liimitations for the discharge (i.e., 7Q10 flow)[1]

For these challenges, GAEPD provided results in terms of the amount of time, in the modeling horizon, when the challenge was observed and the amount of the shortfall (total shortfall for the modeling horizon).

GAEPD asked the Council about additional metrics for which it would like to receive model results. The Council and GAEPD agreed to evaluate the instream flows at the Carsonville node within the Upper Flint River Basin at two thresholds of 100 cfs and 600 cfs. Flow levels used in the metrics were selected to reflect conditions of a low flow (100 cfs) and flows preferred for recreation (600 cfs). The metrics for the BEAM model assessment for this region are summarized in Table 3-1.

The results for the water supply and wastewater discharge metrics are summarized in Table 3-2. These results pertain to the Flint River Basin. A small portion of the Upper Flint Water Planning Region is located in the Ocmulgee and Suwannee River Basins. Results for these basins are not included in this document but can be found in the Middle Ocmulgee and Suwannee-Satilla Regional Water Plans. The Upper Flint Water Planning Council communicates with neighboring Councils to consider assessment results for shared resources and support coordination in their respective Regional Water Plans.

Table 3-1: Upper Flint Region Metrics Evaluated in BEAM Model Assessment

Water Supply Availability	% Model period with water supply challenge Total volume of shortage (for the model period) Shortage volume in 2007-2008 drought Shortage volume in 2011-2012 drought
Wastewater Discharge Assimilation	% Model period with wastewater assimilation challenge
Lake Elevation	None
Streamflow	Carsonville: % model period < 100 cfs Carsonville: % model period < 600 cfs

[1] 7Q10 is a commonly applied metric for assessing low flow conditions. It is the lowest 7-day average flow that occurs on average once every 10 years. Additional information about low flow metrics is available from the Environmental Protection Agency: https://www.epa.gov/ceam/definition-and-characteristics-low-flows

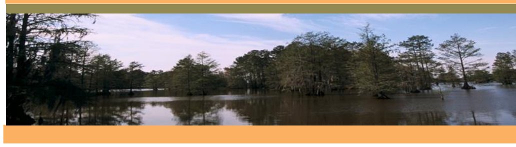


Table 3-2: Summary of Water Supply and Wastewater Discharge Results for Upper Flint Region

	Facility Type	Analyzed *(# of facilities)*	Challenge Indicated *(# of facilities)*
Water Withdrawals	Municipal	10	4
	Industrial	5	3
	Energy	0	0
Wastewater Discharges	Municipal	16	11
	Industrial	1	0
Note: For each challenge indicated in the assessment results, the challenges were observed under both current and future conditions. Future assessment results are discussed in Section 5.1.			

Table 3-3 summarizes the results for the 7 facilities where water supply challenges in the region were observed. Of these challenges, 4 were municipal, while 3 were industrial facilities.

Table 3-4 summarize the results for 11 facilities in the region where flows fell below the 7Q10 flow at some time(s) during the 80-year model period. Most of these low flow periods would not be considered to result in substantial wastewater assimilation challenges, as the percent of time that the instream flow fell below the 7Q10 value is less than 10%. At Byromville Water Pollution Control Plant, the percent of time exceeds 10% and indicates a wastewater assimilation challenge.. Additionally, Table 3-4 lists one facility that is in the Flint River Basin but located in the Upper Ocmulgee Water Planning Region. This facility is not included in the count of facilities in the region with challenges in Table 3-2, but it is included here to support inter-council coordination. The challenge indicated for this facility is not considered to be substantial. All facilities in Table 3-4 are municipal wastewater treatment facilities.

These challenges were reviewed by the Council. In general, they indicate where potential shortfalls may be a challenge in meeting the water and wastewater needs of the region. The amounts, locations, duration, and volume of the shortfalls, especially during dry periods, were examined where additional information was requested by the Council. GAEPD will use this information to guide communications with these facilities about future capacity and permit requirements.

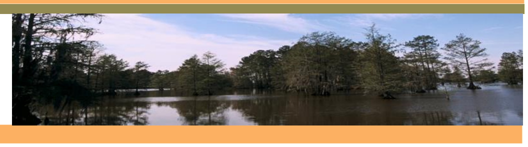


Table 3-3: Water Supply Challenges Indicated in Assessment Results

Facility	Metric		Scenario: Baseline	Scenario: Baseline Drought
Covia Holdings Corp.	% Time		0.06%	0.05%
	Shortage *million gallons*	Model Period	1.0	0.7
		2007-08 Drought	0	0
		2011-12 Drought	0	0
Southern Mills, Inc.	% Time		4.9%	4.4%
	Shortage *million gallons*	Model Period	283	232
		2007-08 Drought	38	34
		2011-12 Drought	61	52
Roosevelt Warm Springs Institute	% Time		0.4%	0.2%
	Shortage *million gallons*	Model Period	11	3
		2007-08 Drought	3	1
		2011-12 Drought	4	1
City of Warm Springs	% Time		0.02%	0.0%
	Shortage *million gallons*	Model Period	0.1	0
		2007-08 Drought	0	0
		2011-12 Drought	0	0
City of Manchester	% Time		15.8%	15.9%
	Shortage *million gallons*	Model Period	3,762	3,830
		2007-08 Drought	326	331
		2011-12 Drought	426	434
City of Thomaston	% Time		3.1%	3.3%
	Shortage *million gallons*	Model Period	1,584	1,642
		2007-08 Drought	355	379
		2011-12 Drought	301	327
Covia Financial Corporation	% Time		0.1%	0.1%
	Shortage *million gallons*	Model Period	11	17
		2007-08 Drought	0	0
		2011-12 Drought	0	0

**% Time is calculated as a proportion of the full model period (1939-2018). Shortage is total volume for full model period or for the drought period indicated. Each drought period includes the full two years listed.*

Table 3-4: Wastewater Assimilation Challenges Indicated in Assessment Results

Facility	% Time Flow Below 7Q10*		Required Flow (7Q10) *cfs*
	Baseline Scenario	Baseline Drought Scenario	
Concord: South WPCP	2.5%	2.7%	3.76
City of Warm Springs WPCP	1.1%	0.7%	0.64
Thomaston: Bell Creek WPCP	2.0%	2.3%	13.47
Reynolds WPCP	1.1%	1.2%	33.39
Taylor City: Plant Laurel WPCP	0.3%	0.3%	4.86
City of Oglethorpe	0.01%	0.01%	328.1
Byromville WPCP	8.4%	16.0%	2.85
Cordele: Gum Creek WPCP	2.6%	4.4%	2.56
Ellaville WPCP-1 (GA0050105)	0.05%	0.1%	0.03
Ellaville WPCP-2 (GA0047767)	0.7%	3.2%	10.54
Ellaville WPCP-3 (GA0020931)	0.0%	0.01%	0.11
Additional Facility in Flint River Basin in the Middle Ocmulgee Region			
City of Griffin: Potato Creek	0.19%	0.19%	0.57

**% Time is calculated as a proportion of the full model period (1939-2018).*
WPCP: Water Pollution Control Plant
[Shortage volumes removed from this table per input from GAEPD.]

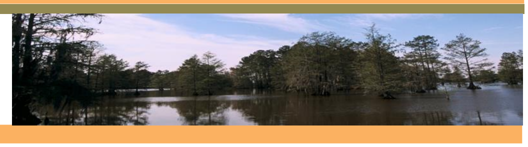


Table 3-5 summarizes the results of the assessment for streamflows at the Carsonville node in the Upper Flint River Basin. As noted above, the streamflow metrics were selected to evaluate the frequency of low flows and recreational flows at Carsonville under various scenarios. This information can be used by the Council to better understand the occurrence and severity of low flows, especially during droughts. The addition of performance metrics during this planning period, as suggested by the Council, can help understand the occurrence of days optimal for recreation. Additional metrics will be discussed by the Council for consideration in future planning cycles.

Table 3-5: Surface Water Availability Streamflow Results

Carsonville Flow Summary	Streamflow Metric *cfs*	Scenario	
		Baseline	**Baseline Drought**
% Time Below Streamflow Metric	100	0.90%	1.01%
	600	23.6%	23.9%
***% Time is for calculated as a proportion of the full model period (1939-2018).*			

In the last planning cycle, GAEPD extended the resource assessment to evaluate the potential impacts of farm ponds used for irrigation on surface water availability. To support this analysis, GAEPD collected data on the bathymetry of a set of farm ponds in South Georgia and gathered input from farmers on how farm ponds are managed. This information was limited in scope, but it provided enough data to support a preliminary analysis. This analysis used the model from the prior planning cycle, and it was not incorporated in the BEAM analysis in this planning cycle. However, the results of this analysis showed that farm ponds had a mitigating impact on the magnitude of availability shortfalls but not on their duration. In Management Practice SF-4 in Section 6.2, the Council encourages greater utilization of farm ponds for water management in the region, with permit conditions that limit potential adverse impacts to flows during dry periods. In the Recommendations to the State (Section 6.3), the Council advocates for further study to improve understanding of farm pond operations and impacts (Recommendation IN-7).

3.2.2 Groundwater Availability

For regional water planning, GAEPD prioritizes aquifers for assessment based on characteristics of the aquifer, availability and use of the aquifer, evidence of negative effects, forecasts that project large increases in use, the aquifer's potential ability to support additional withdrawals, and other considerations. The Council considers results of the groundwater availability assessments when selecting the management practices (Section 6) and recommendations to the State (Section 7.4).

In the Upper Flint region, GAEPD prioritized assessment of portions of the Floridan, Cretaceous, and Claiborne Aquifers. Some additional analyses of groundwater availability for the Claiborne and Cretaceous Aquifers are also presented in this section, including an assessment of aquifer response to increased time-varying withdrawals during peak usage (agricultural growing season) and during non-use (winter months).

Figure 3-3 illustrates the aquifers of Georgia, and Figure 3-4 illustrates a cross-section of the aquifers of the Coastal Plain of Georgia.

Groundwater Availability Assessment Approach

The groundwater assessments estimate the sustainable yield range for the prioritized aquifers. For the purposes of this groundwater assessment, sustainable yield is the amount of groundwater that can be withdrawn without causing the following unwanted results:

- Drawdown between pumping wells exceeds 30 feet
- Reduction in aquifer storage goes beyond a new base level
- Groundwater does not recover between periods of higher pumping.
- Reduction in groundwater contribution to stream baseflow exceeds 40%
- Groundwater levels go below top of confining layer

The assessment estimates sustainable yield by simulating withdrawals until a threshold for one of these potential impacts is reached. That threshold is used to estimate the sustainable yield.

The sustainable yield model results for each aquifer are expressed as a range to encompass two model scenarios with different assumptions about groundwater use. The low-end of the range is defined by a model scenario assuming that groundwater pumping will increase uniformly across the aquifer from existing well locations. The high-end of the range is defined by a model scenario assuming that groundwater use will increase in a non-uniform manner geographically. This latter scenario allows for a flexible distribution of water use in the region that holds use constant in areas where adverse impacts are observed and increases use in other areas where adverse impacts are not observed to spread the withdrawals out over the aquifer area, which yields potential higher levels of use from the aquifer. In the assessment, aquifer use was increased until a threshold for adverse impacts was met. The low-end value is not necessarily the level at which impacts will be seen. Aquifer responses in the future depend on pumping configurations – where wells are located and how much pumping is applied at each location.[2]

[2] For more detail on the groundwater availability resource assessment and results, see the March 2010 Synopsis Report: Groundwater Availability Resource assessment and the March 2017 Synopsis Report: Groundwater Availability Assessment Updates; both are available on the state water planning website: https://waterplanning.georgia.gov/resource-assessments/ground-water-availability.

Figure 3-3: Georgia's Aquifers

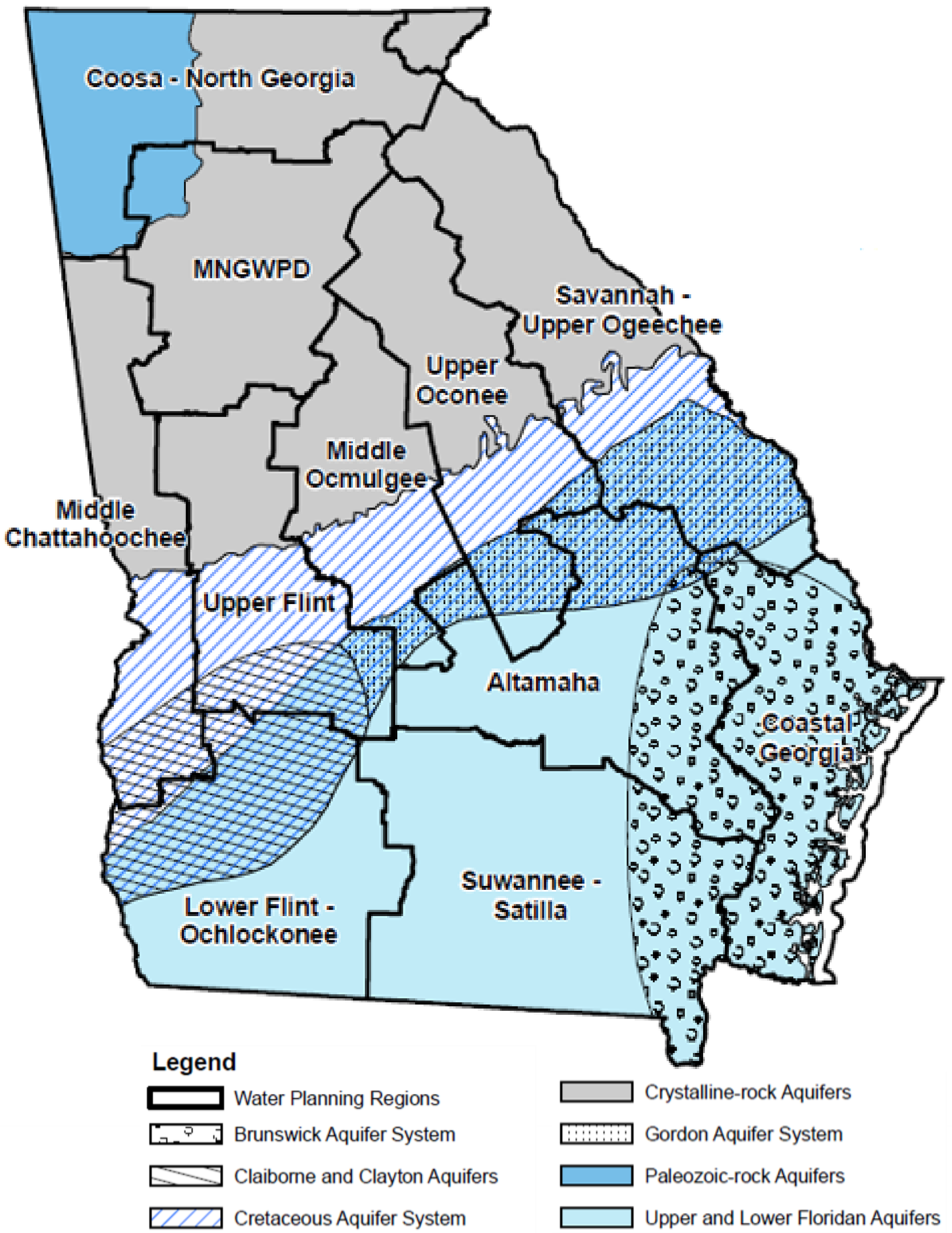
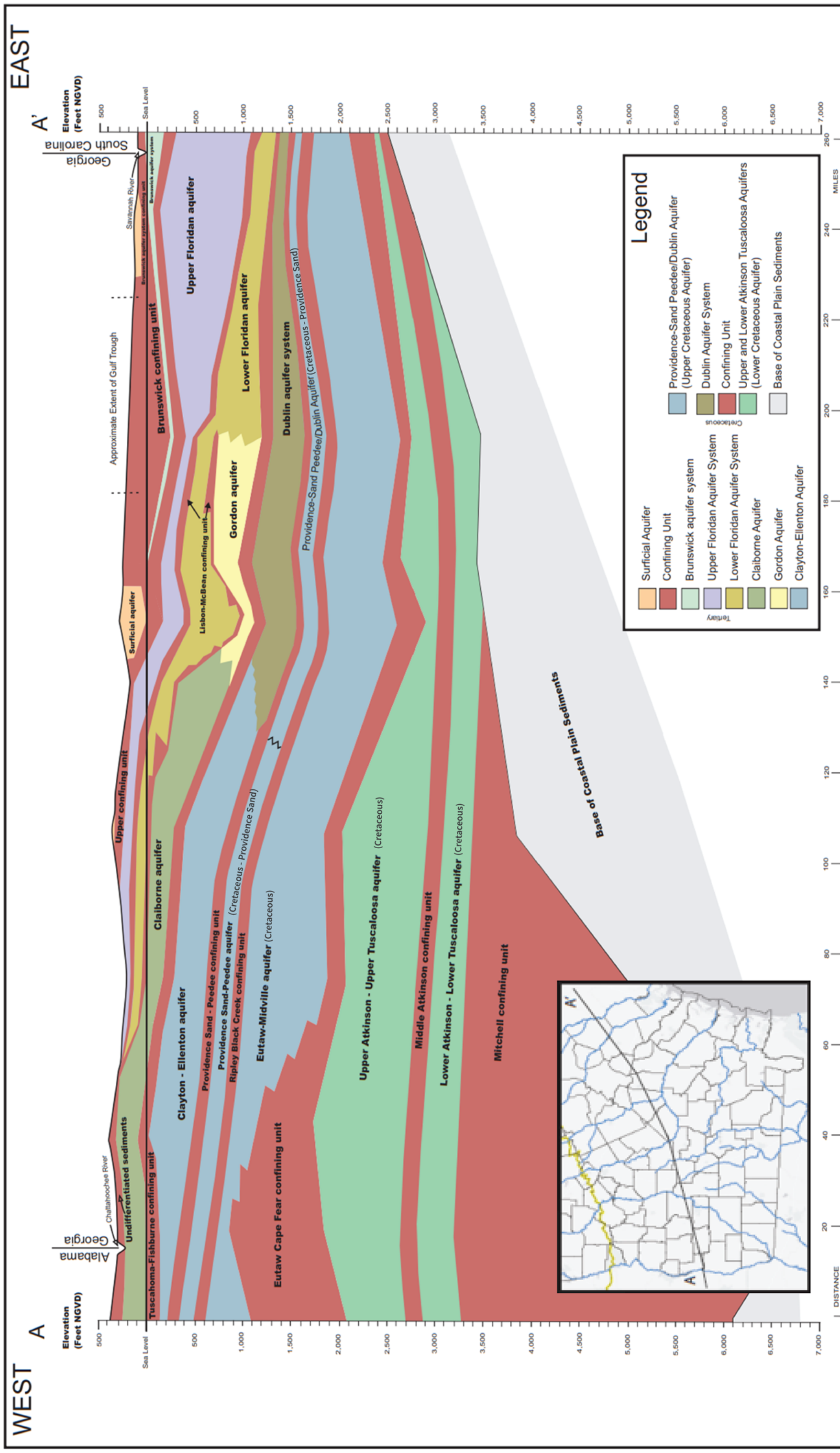


Figure 3-4: Coastal Plain Aquifers Cross-Section



Source Modified from Renken, 1996; Miller, 1990 and Miller, 1986

Groundwater Availability Assessment Results

Figures 3-5, 3-6, and 3-9 through 3-11 show the estimated sustainable yields and current use for the assessed aquifers in this region. The figures include maps of the portion of each assessed aquifer. The estimates of current use can be compared to the estimated sustainable yield. The current use estimates are provided at two scales: (1) use that occurs in the portion of the assessed aquifer that is within this water planning region, and (2) use that occurs in the full assessed area of the aquifer (illustrated on the maps in Figures 3-5, 3-6, and 3-9 through 3-11). Current aquifer use is estimated for the year 2020 and incorporates municipal, industrial, and energy sector groundwater use, as well as agricultural use during dry year conditions (see Section 4 for details on estimated 2020 water use). Section 5 includes a comparison of the sustainable yield results to the forecasted 2060 demand.

In summary, the results indicate estimated 2020 use is below the estimated sustainable yield range in the Claiborne and the South-Central Georgia in the Floridan Aquifer but above the estimated sustainable yield range for the Dougherty Plain in the Floridan Aquifer (aquifer wide) and within the estimated sustainable yield range (between low- and high-end) for the Cretaceous Aquifer in the Upper Flint Region.

The Crystalline Rock Aquifer in the Piedmont region of the state occurs but was not assessed in this region. Use of this aquifer is generally limited by dependence on finding a water-bearing fracture that is productive enough over a long period of time to meet the user’s needs. GAEPD does have some information to guide permitting in this aquifer.

In some cases, the range for the sustainable yield (low-end to high-end) is large. As noted above, the low-end assumes a uniform distribution of increased pumping, while the high-end assumes a non-uniform distribution of increased pumping. In the latter, the model scenario spreads pumping to areas where there is less pumping, and this scenario helps to estimate the maximum amount that the aquifer can yield. The sustainable yield of an aquifer is difficult to assess at a broad scale, and preventing adverse impacts requires attention to location-specific conditions. When considering the sustainable yield range, the Council acknowledges that the range is a general guide to potential wide-scale impacts and adverse impacts could be observed at any location. When withdrawals are estimated or projected to exceed sustainable yield, the results do not necessarily indicate that the aquifer is likely to be exhausted by use. Usually, more information is needed, and management practices may be needed to address potential impacts.

Floridan Aquifer Results: The Floridan Aquifer was assessed in two areas that occur in the Upper Flint Region: the Dougherty Plain and South-Central Georgia (see Figures 3-5 and 3-6). These two assessments overlap in the southern part of the region. In the South-Central Georgia part of the aquifer, current use is below the level of the low-end sustainable yield.

The Dougherty Plain assessment in this region provides a more detailed look at the unconfined portion of the aquifer where it is closely connected with surface water. In this region, the use of the Floridan Aquifer can negatively affect baseflow to surface water streams. To address this area of close interconnection, the Dougherty Plain assessment incorporates an additional model component (i.e., USGS Modular Finite Model, Jones and Torak, 1993) to provide estimates of the impacts on baseflow.[3] Assessment of the Dougherty Plain, although it only includes a small portion of the Upper Flint Region, is a regionally important because it is a major source of agricultural water withdrawals in Sumter, Crisp, and Dooly Counties.

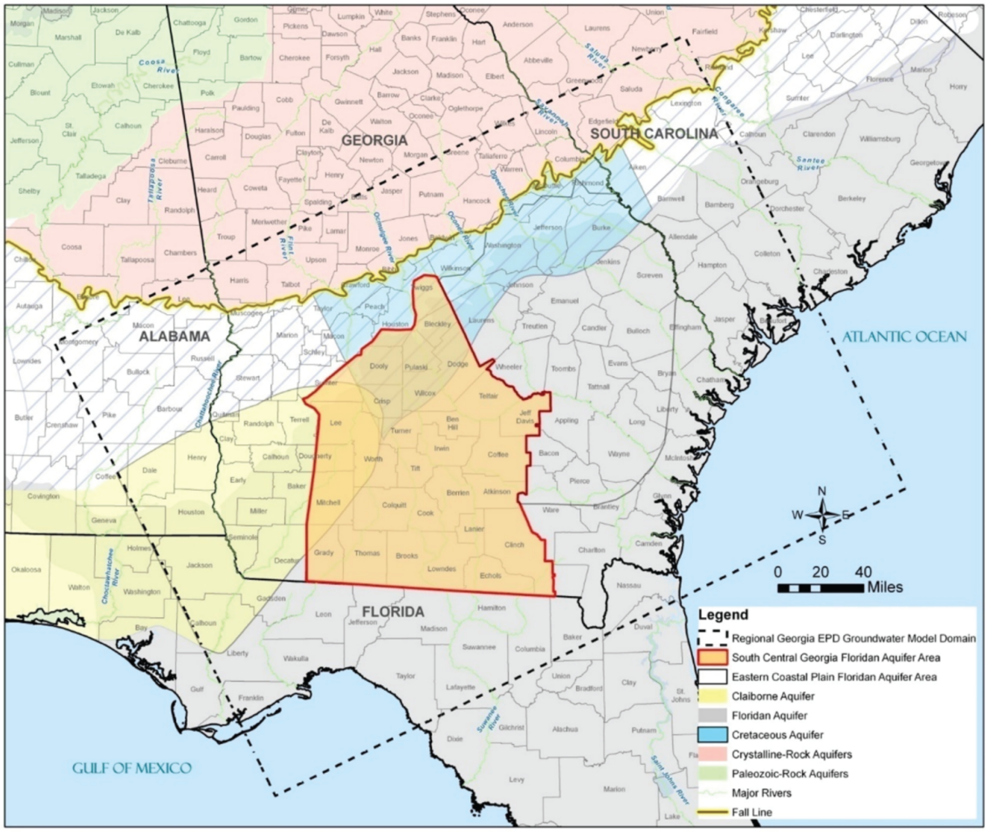
While pumping from Floridan Aquifer in the Dougherty Plain is 25 mgd in this region, across the full range of the assessed area, pumping demands currently exceed the high-end of the estimated sustainable yield. The sustainable yield results for the Dougherty Plain (Figure 3-6) were determined by the modeled impact of groundwater withdrawals on groundwater contributions to stream baseflows. In other assessed aquifer units, the change in baseflow contribution to streams was evaluated at the level of the whole aquifer unit, but for the Upper Floridan Aquifer in the Dougherty Plain, estimates of sustainable yield were determined by changes in groundwater contribution to stream baseflow on a reach-by-reach basis. This finer-scale analysis represents a more conservative approach to the analysis.

In the resource assessment model runs for this aquifer, localized thresholds for groundwater contributions to stream baseflows were reached when impacts on the aquifer itself were minimal. Because there is a close connection between the Floridan aquifer and the rivers, permanent aquifer drawdown is not a major concern because the rivers would recharge the aquifer under increased withdrawal scenarios. The impacts of use of this portion of the aquifer are through the impacts to streamflow.

Therefore, the Council considered the results of the groundwater assessment for this aquifer together with those for the surface water availability assessment and in the context of existing policy that affects groundwater and surface water use in this area. Since 2012, there has been a moratorium on new and expanded withdrawals from the Floridan Aquifer in the Dougherty Plain. Figure 3-7 provides a map of the moratorium area. Prior to the moratorium, and if the moratorium is lifted, withdrawals from the aquifer are managed per the 2006 Flint River Basin Plan, which sets geographic zones (restricted use, capacity use, and conservation use) with increasing levels of restrictions on aquifer withdrawals based on potential impacts on streamflow. Figure 3-8 is a map of these management zones. No new agricultural withdrawals from the Floridan aquifer are permitted at this time in areas that are modeled to have the greatest impact on streamflow.

[3] USGS Modular Finite Element Model (Jones and Torak, 1993) https://doi.org/10.3133/twri06A3

Figure 3-5: Floridan Aquifer: South Central Georgia – Model Domain and Sustainable Yield



Floridan Aquifer: South Central Georgia*

Estimated Sustainable Yield Range	*Current Use (2020)*	
	Upper Flint Region	**Aquifer-Wide**
622 to 836 mgd	25 mgd	488 mgd

** Also indicated are other aquifer regions modeled for regional water planning. The Claiborne (yellow) and Cretaceous (blue) are depicted in other figures and discussed in this plan.*

Figure 3-6: Floridan Aquifer: Dougherty Plain –
Model Domain and Estimated Sustainable Yield Range

Floridan Aquifer in the Dougherty Plain*

Estimated Sustainable Yield Range	*Current Use (2020)*	
	Upper Flint Region	**Aquifer-Wide**
237 to 328 mgd	25 mgd	441 mgd

** Also indicated are other aquifer regions modeled for regional water planning. The Claiborne (yellow), Cretaceous(green), and Floridan South Central Georgia (orange line) are depicted in other figures and discussed in this plan.*

Figure 3-7: ***Moratorium on New and Expanded Agricultural Water Withdrawal Permits***

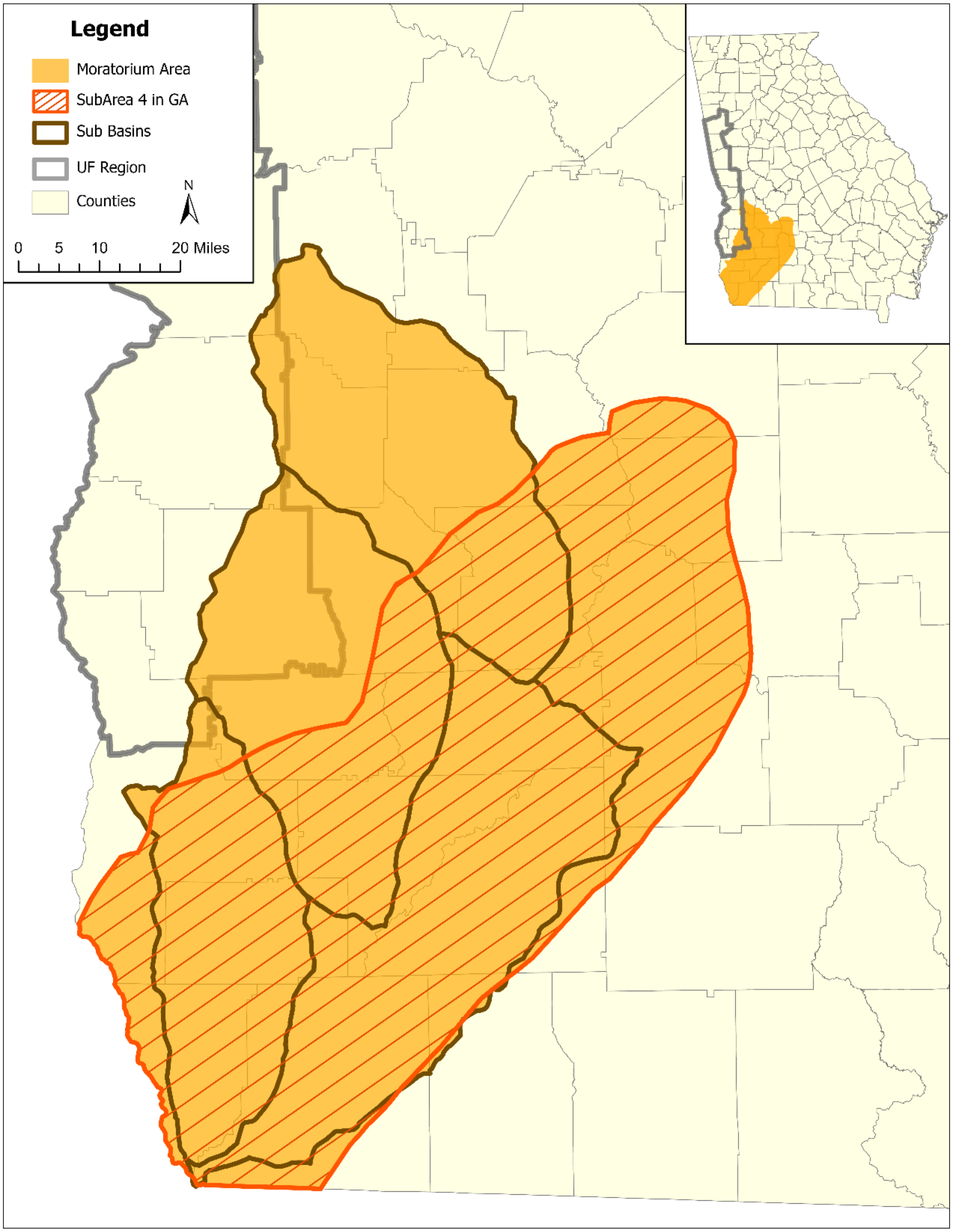
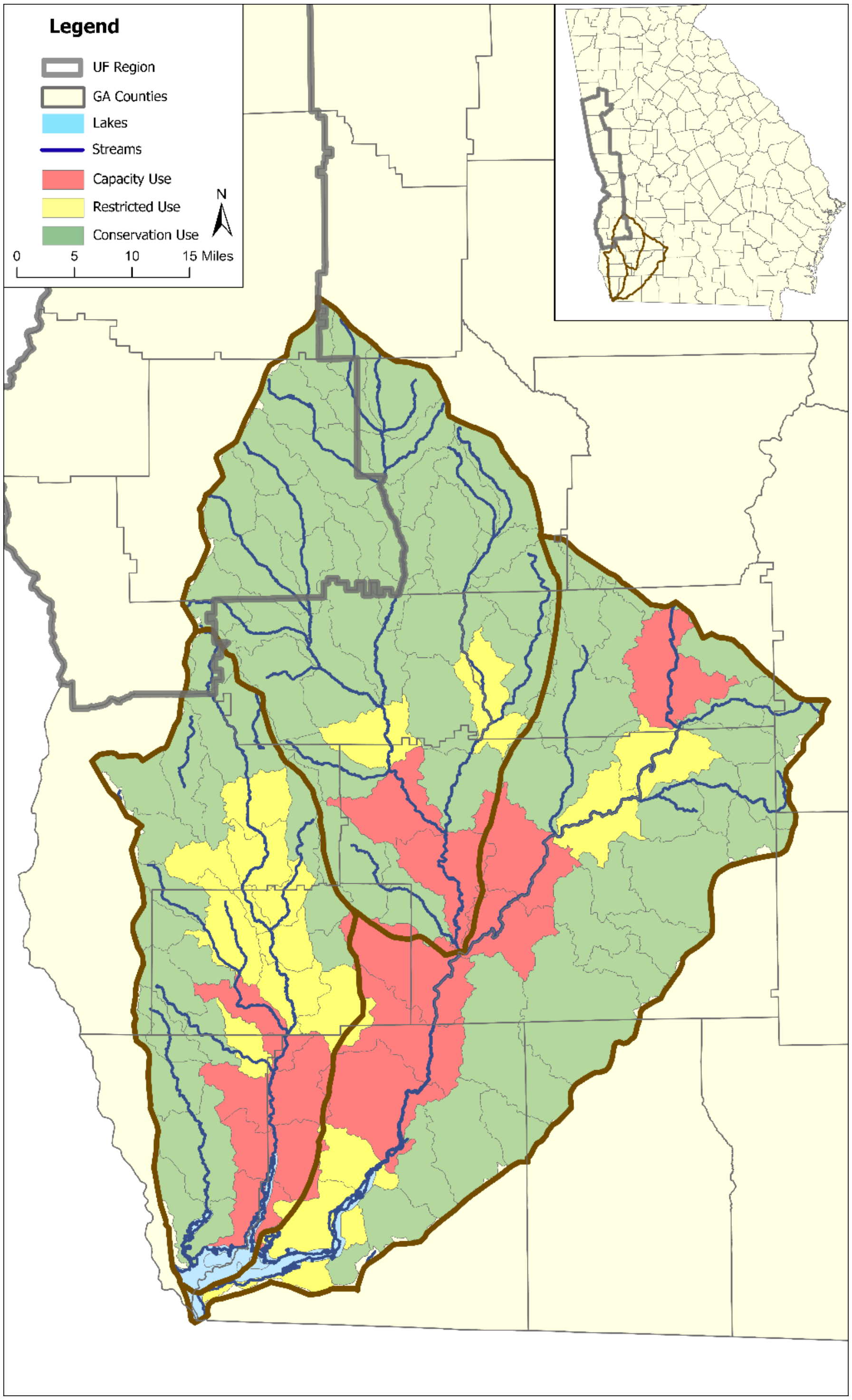


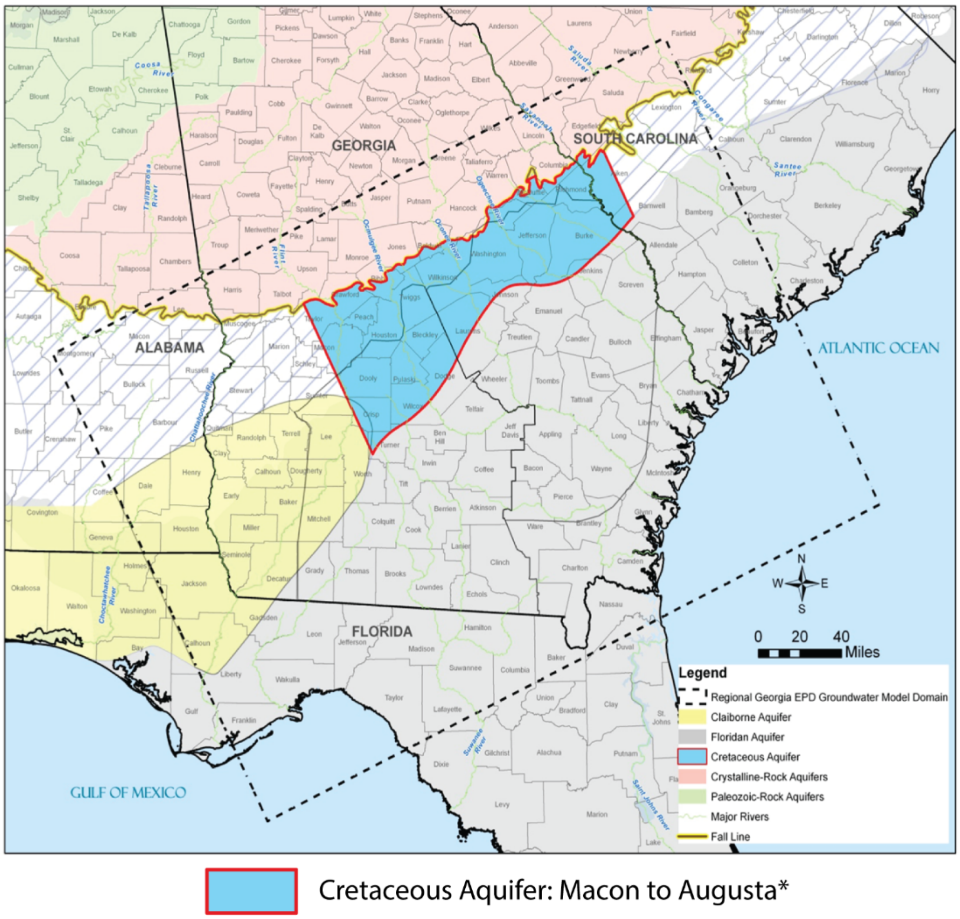
Figure 3-8: Agricultural Water Withdrawal Permit Management Zones based on 2006 Flint Plan



Cretaceous Aquifer Results: For the Cretaceous Aquifer, results are presented for two different areas. The first area extends from Macon to Augusta (estimated sustainable yield range 347-445 mgd), and the second area is focused on a portion of the aquifer totally within the Upper Flint region (estimated sustainable yield range 50-201 mgd). The latter area was assessed to provide more region-specific information to this Council. The estimated sustainable yield ranges and estimates of current use for these two areas are presented in Figures 3-9 and 3-10.

In these analyses, sustainable yield is estimated based on two of the assessment metrics: limiting aquifer drawdown to 30 feet and limiting reduction in groundwater contribution to surface water baseflow to 40%. The results indicate that for the larger area (Macon to Augusta), pumping demands are below the sustainable yield. However, in the Upper Flint Region, the more focused analysis shows that use is within the sustainable yield range for this aquifer.

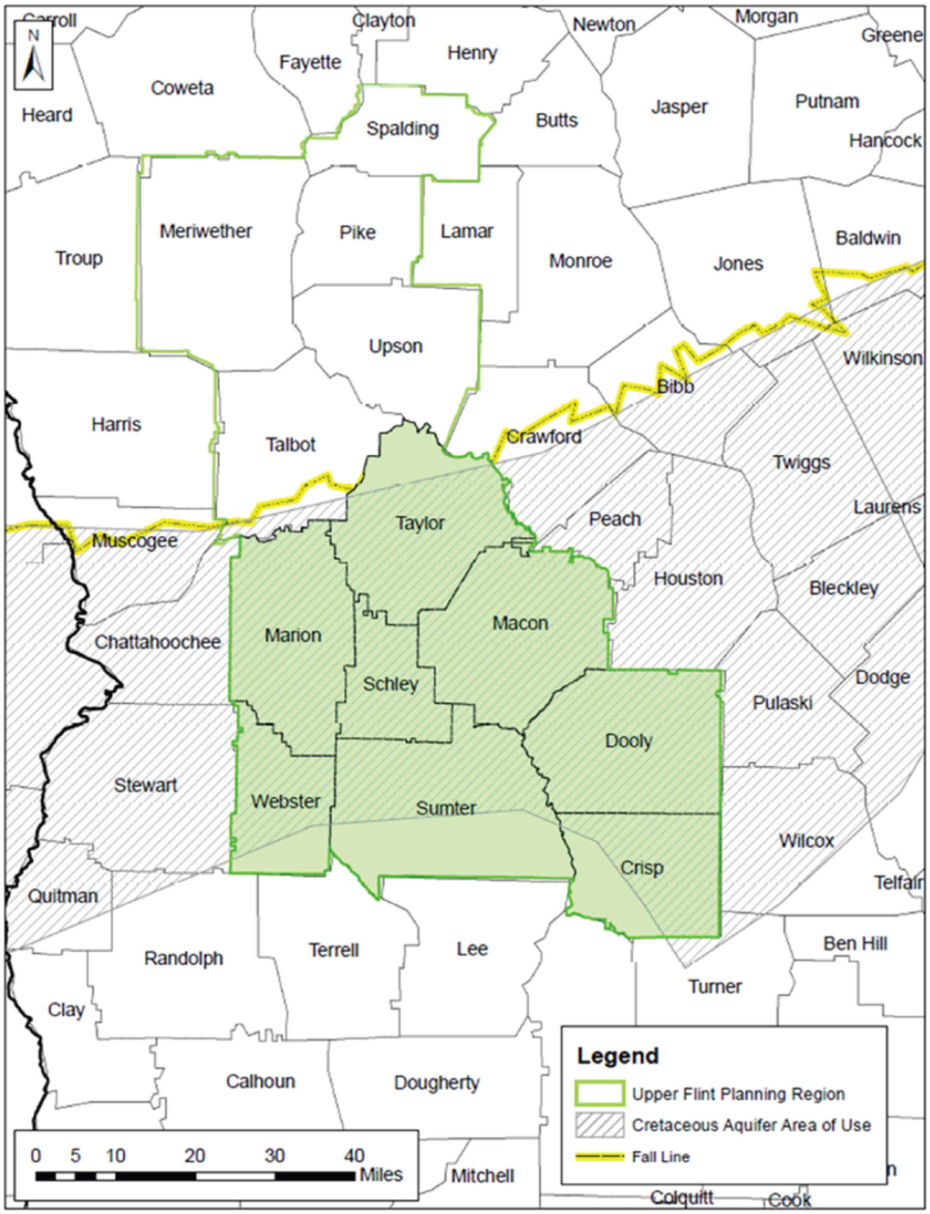
Figure 3-9: Cretaceous Aquifer Between Macon and Augusta – Model Domain and Sustainable Yield



Estimated Sustainable Yield Range	*Current Use (2020)*	
	Upper Flint Region	**Aquifer-Wide**
347 to 445 mgd	51 mgd	170 mgd

** Also indicated are other aquifer regions modeled for regional water planning. The Claiborne (yellow) is depicted in other figures and discussed in this plan.*

Figure 3-10: Cretaceous Aquifer: Upper Flint Region – Model Domain and Sustainable Yield



Cretaceous Aquifer: Upper Flint Region

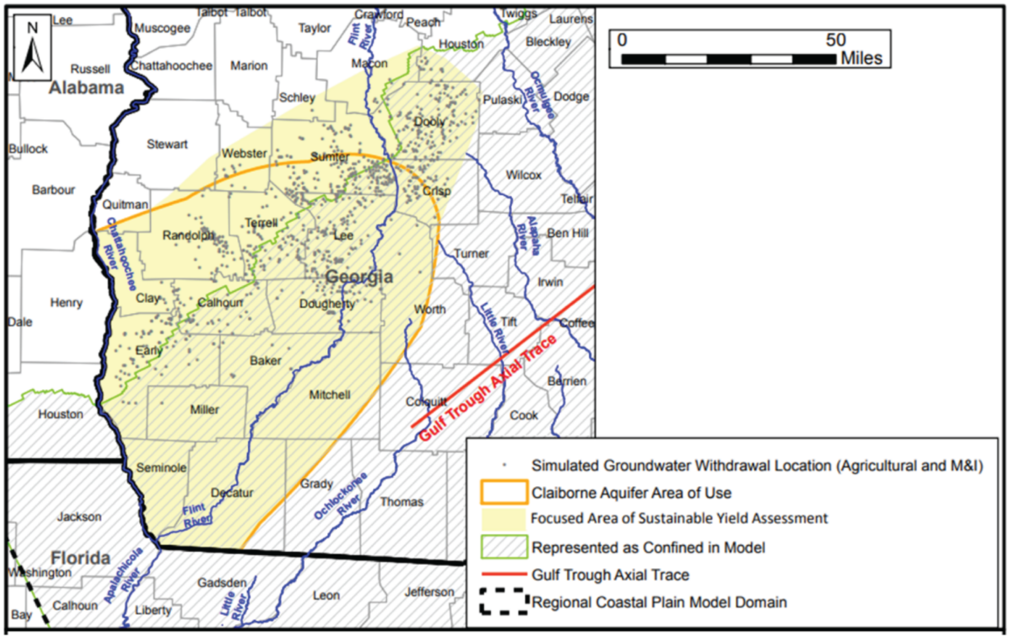
Estimated Sustainable Yield Range for Upper Flint Region	Current Use (2020) Upper Flint Region
50 to 201 mgd	51 mgd

Claiborne Aquifer Results: For the Claiborne Aquifer, estimates of sustainable yield and 2020 use are presented in Figure 3-11, which shows the assessed area in the yellow shaded area. In this planning cycle, the assessed portion was extended from the area outlined in orange to the yellow shaded area. The assessed area was extended to the north and northeast to include portions of Webster, Stewart, Randolph, Schley, Macon, Houston, Dooly, and Crisp Counties where there were active Claiborne aquifer wells that were not included in the prior analysis.

For the Claiborne Aquifer, the estimated sustainable yield results indicate that the effects of use on this aquifer depend upon the location of withdrawals. The results indicate that some areas may have additional water that can be used sustainably, while other parts may show potential adverse impacts of use.[4] As a part of the Claiborne Aquifer assessment in this planning cycle, county-level estimates of sustainable yield were developed. Table 3-6 lists the county level sustainable yields for the Claiborne Aquifer for counties in the Upper Flint region and includes an estimate of 2020 use of the aquifer in each listed county.

[4] These results are corroborated by those of a GEFA-funded study on characteristics of the Claiborne Aquifer (CDM Smith, *Claiborne Aquifer Specific Capacity and Transmissivity Analysis Draft Report*, December 2016).

Figure 3-11: Claiborne Aquifer – Model Domain and Sustainable Yield



Estimated Sustainable Yield Range	*Current Use (2020)*	
	Upper Flint Region	**Aquifer-Wide**
141 to 803 mgd	55 mgd	71 mgd

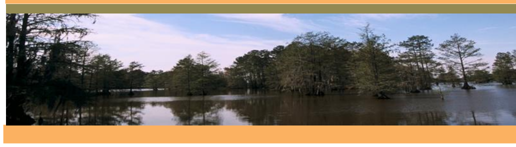


Table 3-6: Claiborne Aquifer – High-End of Sustainable Yield for the Counties in the Upper Flint Region

County	**Current Use (2020)** *mgd*	**High-End Sustainable Yield** *mgd*
Crisp	6.7	37.4
Dooly	14.5	83.1
Macon	0.6	34.7
Marion	0	1.2
Schley	0.1	16.6
Sumter	26.1	116.5
Webster	0.1	41.1

3.2.3 Surface Water Quality

The water quality assessment modeled the capacity of Georgia's surface waters to reduce pollutants without unacceptable degradation of water quality. The term assimilative capacity refers to the ability of a water body to naturally absorb pollutants via chemical and biological processes without exceeding state water quality standards or harming aquatic life.

The water quality assessment focused on available assimilative capacity for oxygen consuming wastes (affecting dissolved oxygen (DO)), nutrients (specifically total nitrogen and total phosphorus) and chlorophyll-*a* (a green pigment found in algae; the concentration of chlorophyll-*a* is used to assess lake water quality). Assessment of the ability to assimilate oxygen consuming wastes is important because aquatic life is dependent upon the amount of residual dissolved oxygen available in a stream.

Two water quality model evaluations were performed:

1. River Model (Dissolved Oxygen Modeling) – This model evaluated dissolved oxygen due to existing point discharges under critical conditions. For the Flint River, a dynamic model was used that reflects varying conditions and also incorporated potential effects from nonpoint source stormwater runoff based on varying land uses.
2. Lake and Watershed Models (Nutrient Modeling) – These models evaluated the impacts of nutrients loadings from point and nonpoint sources, nutrient levels (specifically total nitrogen and total phosphorus), and chlorophyll-*a*. The watershed and lake models accounted for nutrient sources from both wastewater discharges and nonpoint source stormwater runoff based on various land uses.

The water quality assessment is not the same as the 303(d) list of impaired waters for two reasons. First, this assessment only looked at dissolved oxygen and nutrients; the 303(d) list includes stream reaches listed as impaired on the basis of dissolved oxygen and other parameters, such as metals, bacteria, and biota. Second, the 303(d) list is based on analytical results from stream monitoring while the water quality assessment is based on model results. Waters in the Upper Flint Water Planning Region that are included on the 303(d) list of impaired waters are discussed in Section 3.3.1.

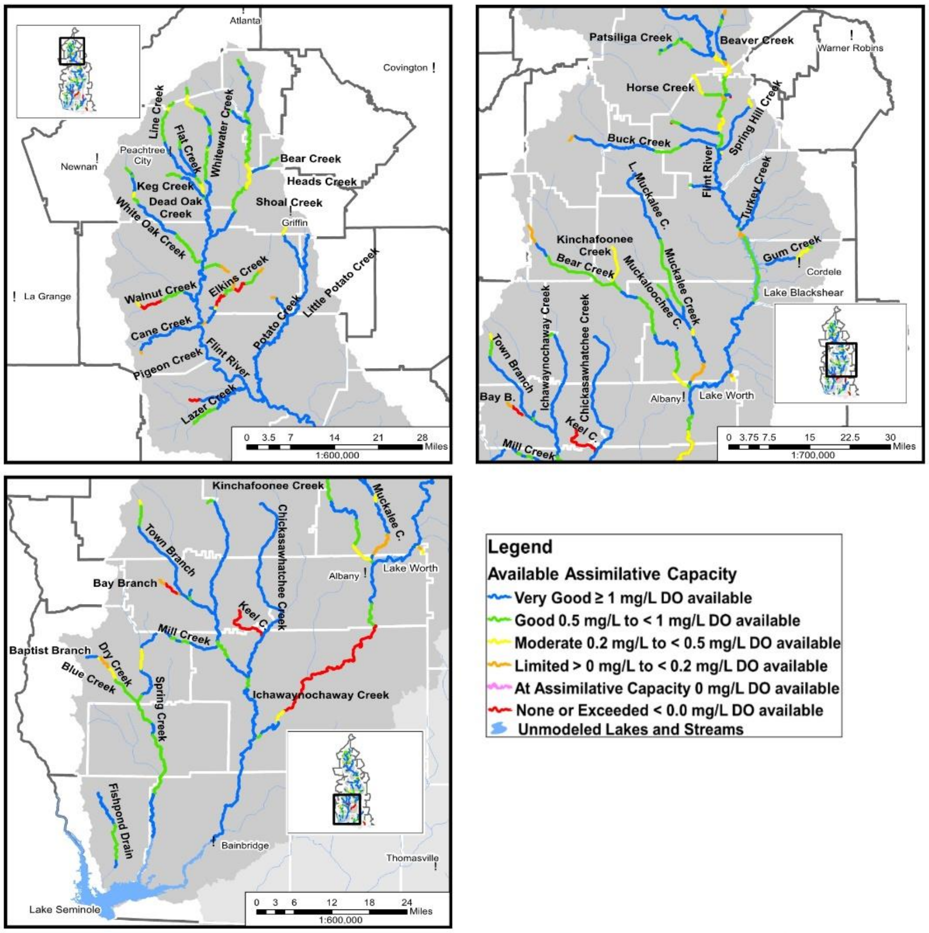
Determining assimilative capacity requires information on the stream flow, in-stream water quality, wastewater discharges, water withdrawals, land application systems, weather information, land use, stream hydrology, topography, and state water quality standards. The water quality models were developed to show the status of the available assimilative capacity based on wastewater discharges at currently permitted levels. They were also used to evaluate future conditions (see Section 5.3).

Dissolved Oxygen Modeling

Figure 3-12 shows the in-stream dissolved oxygen model results for current discharges given critical low flow (7Q10), high temperature conditions. The current conditions assimilative capacity analysis incorporated municipal and industrial wastewater facilities operating at their full permitted discharge levels (flow and effluent discharge limits as of 2019). Stream segments that were predicted by the model to exceed the available assimilative capacity are shown in red. Streams that modeled at the allowable DO levels are shown in pink, and those predicted to have very good DO levels relative to state water quality standards are shown in blue.

It is important to note that some streams are naturally low in DO, but these streams cannot necessarily be discerned in Figure 3-12 because the map indicates the effects of discharges as well as natural conditions for all streams. Assimilative capacity appears to be available in most stream reaches in the Upper Flint Water Planning Region based on dissolved oxygen modeling results. The number of stream miles where model results showed assimilative capacity as exceeded or unavailable under current conditions in the model was 56 miles in the Flint River Basin (as a whole).

Figure 3-12: Assimilative Capacity Results from Dissolved Oxygen Assessment: Flint River Basin (Current)



	Flint Basin-Available Assimilative Capacity (Total Mileage)					
Model Run	Very Good	Good	Moderate	Limited	At Assimilative Capacity	Exceeded
Current	664	267	72	32	0.51	56

Source: EPD, Synopsis Report – Surface Water Quality (Assimilative Capacity) Resource Assessment, July 2022.

Nutrient Modeling

Watershed and lake models results assume water use and wastewater disposal data and corresponding land use profiles as inputs. At the time of publication, the latest data inputs for nutrient loading from the contributing watershed utilize twelves years of observed hydrology from 2005 through 2017. The results from the previous planning cycle will continue to be used to inform water quality related management practices The model results indicated that in the Flint River Basin, nonpoint sources currently contribute, in general, more total nitrogen than point sources, whereas point sources contribute more total phosphorus than nonpoint sources.

The lake models estimated the algal response, in terms of chlorophyll-*a* levels, to nutrient loading at current conditions over the multi-year modeling period. One lake in the Upper Flint Water Planning Region was modeled: Lake Blackshear. The results indicated that in Lake Blackshear, current total phosphorus loading is primarily from point souces. At this time, nutrient standards have not been established for Lake Blackshear, and therefore, these results cannot be compared against nutrient standards. However, the results indicate how nutrient control efforts should be directed to manage current and future nutrient loading.[5] Downstream of the Upper Flint Water Planning Region at the Florida border, Lakes Chehaw and Seminole were also modeled. Similar to Blackshear, the results for these lakes indicated that current total phosphorus loading is primarily from point souces. Like Blackshear, nutrient standards have not been established for Lakes Chehaw and Seminole.

In its review of the models and their results, the Council had several concerns about the lake and watershed model assumptions and inputs. See Section 7.4 for a recommendation related to the Council's concerns about the lake and watershed models.

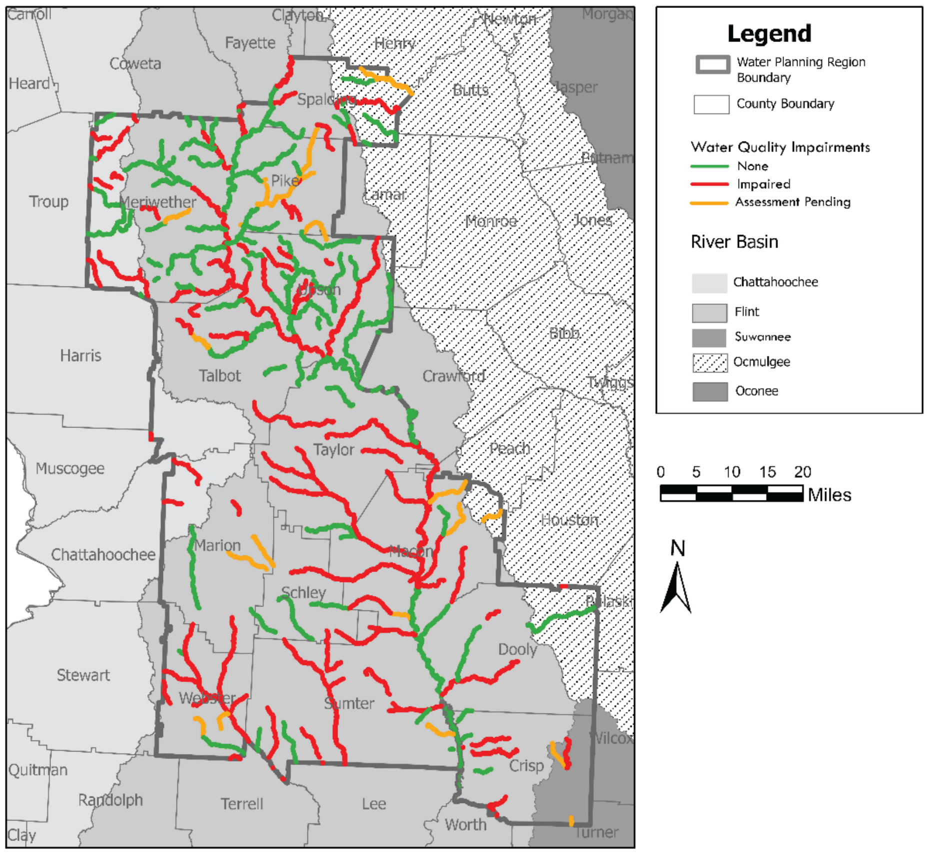
3.3 Ecosystem Conditions and In-stream Uses

3.3.1 303(d) List and TMDLs

The State of Georgia assesses its water bodies for compliance with water quality standards, as required by the federal Clean Water Act. Waters of the State are monitored by GAEPD, USGS, and local authorities contracted by GAEPD. If an assessed water body is found not to meet standards, then it is considered "not supporting" its designated uses, and it is included on a list of impaired waters (303(d) list). Impairments must be addressed by developing a Total Maximum Daily Load (TMDL), which sets a pollutant load and outlines a strategy for corrective action. Several stream reaches in the Upper Flint Water Planning Region are on the State's list of impaired waters. A summary of impaired waters in this water planning region is provided in Figure 3-13.

[5] See Section 5.3 for a discussion of future water quality modeling results.

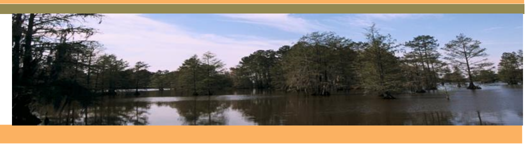
Figure 3-13: Summary of Impaired Waters in the Upper Flint Water Planning Region



River Basin	Total River Miles Impaired in the Upper Flint Region			
Chattahoochee	0	21	0	28
Flint	21	363	47	192
Ocmulgee	0	12	0	13
Suwannee	0	0	0	5
Criterion Violated	DO	Fecal Coliforms	Metal	Other

Note: Stream reaches may have more than one criterion violated, i.e. the sum of DO, Fecal Coliform, Metals, and Other may be greater than the total number of stream miles listed as impaired. Metals include mercury trophic weighted residue value and fish consumptive guidance.

Additional resources for water quality data can be found on GAEPD's Water Quality in Georgia webpage which includes downloadable data for 303(d) information (https://epd.georgia.gov/https%3A/epd.georgia.gov/assessment/water-quality-georgia), Georgia Environmental Monitoring and Assessment System (GOMAS) (https://gomaspublic.gaepd.org), and GAEPD Water Quality in Georgia Story Map (https://storymaps.arcgis.com/stories/67b7b29771b842268f878b94cb7c6d69) .



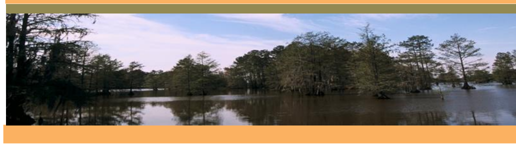
3.3.2 Fisheries, Wildlife, and Recreational Resources

The Georgia Wildlife Resources Division (WRD) developed a broadly focused strategy that indicates areas of the State in which resources should be concentrated to facilitate the conservation of Georgia’s animals, plants, and natural communities in the Georgia State Wildlife Action Plan, September 2015.[6] High priority species and habitats were identified and summarized at the ecoregion level, and a total of five ecoregions were designated for the State. Portions of the Upper Flint Water Planning Region fall within the Piedmont Ecoregion with the remainder in the Southeastern Plains Ecoregion. The WRD Plan identified 87 high priority animal species in the Piedmont ecoregion. These included 17 birds, 3 reptiles, 5 mammals, 3 amphibians, 11 mollusks, 29 fish, 8 aquatic arthropods, and 14 terrestrial arthropods.

Critical habitat areas have been identified for federally listed endangered and threatened species of freshwater mussels in the region; more information can be found on the following U.S. Fish and Wildlife Service ECOS Environmental Conservation Online System website: https://ecos.fws.gov/ecp/report/table/critical-habitat.html.

The Upper Flint Water Planning Region provides boaters, fishermen, and other outdoor enthusiasts with a diverse and easily accessible river environment. Near the fall line, the river provides a scenic area for canoeists and kayakers. Lake Blackshear offers boating and fishing opportunities. Camping, hunting, and hiking trails are recreational options across the region. Important recreational fisheries in the region include shoal bass, largemouth bass, sunfish, bluegill, channel catfish, and flathead catfish. The Department of Natural Resources manages State Parks and Historic Sites, Public Fishing Areas, and Wildlife Management Areas throughout the Upper Flint Water Planning Region.

[6] The Georgia State Wildlife Action Plan, September 2015 is available on-line: https://georgiawildlife.com/WildlifeActionPlan



SUMMARY: This section summarizes future demand forecasts for water and wastewater treatment in the Upper Flint Water Planning Region. Between 2020 and 2060, water demands are forecasted to increase by 32% and wastewater treatment demands are forecasted to increase by 3% in this water planning region.

Section 4. Forecasting Future Water Resource Needs

Water and wastewater demand forecasts, along with the resource assessments (Sections 3 and 5), form the foundation for water planning in the Upper Flint Water Planning Region and serve as the basis for the selection of water management practices (Section 6). Figures 4-2 and 4-3 included at the end of this section present the regional water and wastewater forecasts from 2020 through 2060 for four water use sectors: municipal, industrial, agriculture, and thermoelectric power generation. These forecasts provide estimates of baseline levels of water use in the region and illustrate how those levels are expected to change over the planning horizon. More details on demand forecasts for each water use sector can be found in the technical memorandums and Georgia Water Planning Forecast Dashboard, which are available on the Regional Water Planning website[1].

The Council notes that the resources of the Upper Flint River Basin are subject to substantial use upstream by water and wastewater systems in the Metropolitan North Georgia Water Planning District. Furthermore, septic tank use in the District, as well as this region, contribute to consumptive use in the Basin. The forecasts for water and wastewater trends for the District are addressed in the District's Water Resource Management Plan.[2]

4.1 Municipal Forecasts

Municipal forecasts include residential, commercial, and small industry demands. Municipal water demand and wastewater forecasts were based on population projections that were developed by the Governor's Office of Planning and Budget (OPB). In summary, the projections show that population in the Upper Flint Water Planning Region is expected to increase by 3.4% from 243,577 in 2020 to 251,824 in 2060. Table 4-1 provides the county-level population projections for this water planning region. These projections are discussed in greater detail in the forecasting technical memorandum, on the Regional Water Planning website.

Demands for major water using industries were projected separately and are discussed in Section 4.2.

[1] More information regarding Municipal, Industrial, Agricultural, and Energy forecasts can be found on the Regional Water Planning website: https://waterplanning.georgia.gov/forecasting
[2] https://northgeorgiawater.org/plans-manuals/

Table 4-1: Municipal Water Demand Forecast (MGD)

County	2020	2030	2040	2050	2060	% Change 2020 to 2060
Crisp	22,289	21,462	20,318	18,978	17,921	-20%
Dooly	13,400	12,337	11,233	10,118	9,306	-31%
Macon	12,988	12,170	11,175	10,180	9,505	-27%
Marion	8,293	7,984	7,586	7,058	6,750	-19%
Meriwether	21,020	20,895	20,467	19,983	19,883	-5%
Pike	18,860	20,147	21,335	22,276	23,262	23%
Schley	5,275	5,494	5,744	5,949	6,126	16%
Spalding	69,110	80,827	87,491	93,135	99,563	44%
Sumter	29,399	27,810	25,619	23,413	21,579	-27%
Talbot	6,158	5,572	4,857	4,143	3,740	-39%
Taylor	7,958	7,620	7,249	6,865	6,663	-16%
Upson	26,277	26,583	26,461	26,023	25,829	-2%
Webster	2,550	2,276	2,030	1,816	1,697	-33%
TOTAL	**243,577**	**251,177**	**251,565**	**249,937**	**251,824**	**3%**

4.1.1 Municipal Water Forecasts

The municipal water forecasts were calculated by multiplying an updated estimate of per capita water use by the population served. For most counties, the per capita demands were calculated by averaging the per capita water use values calculated using water loss audits submitted to GAEPD from 2015 to 2018[3].

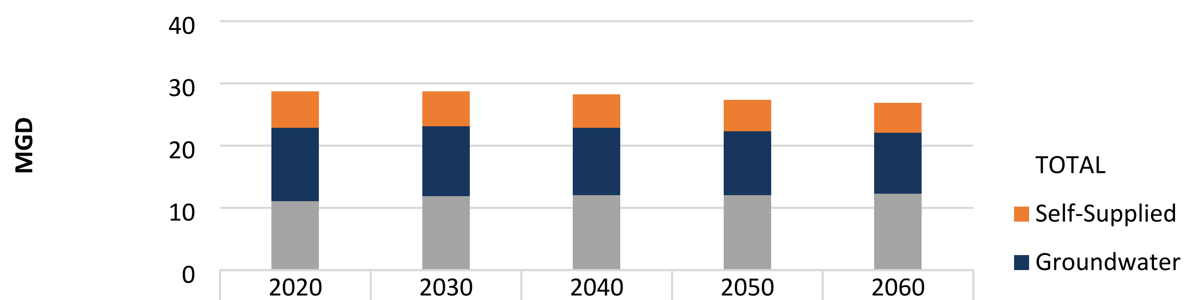
The per capita use rates also reflect adjustment for expected water savings over time from the transition to ultra-low flow toilets (1.28 gallons per flush maximum), as required by the Water Stewardship Act as of 2010. Additional details regarding development of the municipal water forecasts, including the per capita use rate, plumbing code savings, and results, are provided in the municipal forecasting technical memorandum[4].

[3] Per capita water demand was calculated based on the data available. For most counties, the averaged per capita demands values from water loss audits submitted to EPD from 2015 to 2018 were used. For some counties, the demand was calculated using withdrawal data submitted to EPD and the population served in the Safe Drinking Water Information System database or other total population sources.

[4] More information regarding Municipal Forecasts can be found on the Regional Water Planning website at: https://waterplanning.georgia.gov/forecasting/municipal-water-use

The resulting municipal water forecasts are shown in Figure 4-2. They project that demand for municipal water in the Upper Flint Water Planning Region (including publicly-supplied and self-supplied demand) is expected to decrease from 28.70 mgd in 2020 to 26.84 mgd in 2060. Of these amounts, estimated water withdrawals are expected to be 39% from surface water, 41% from groundwater by municipal systems, and 20% from private wells (self-supply) in 2020. In 2060, estimated water withdrawals are estimated to be 46% from surface water,37% from groundwater by municipal systems, and 18% from private wells (self-supply) in 2060. Figure 4-1 illustrates the total municipal water demand separated by source.

Figure 4-1: Total Municipal Water Demand (AAD-MGD)



	2020	2030	2040	2050	2060
TOTAL	28.7	28.72	28.2	27.36	26.84
Self-Supplied	5.79	5.58	5.3	4.99	4.76
Groundwater	11.79	11.24	10.83	10.27	9.81
Surface Water	11.12	11.9	12.07	12.1	12.27

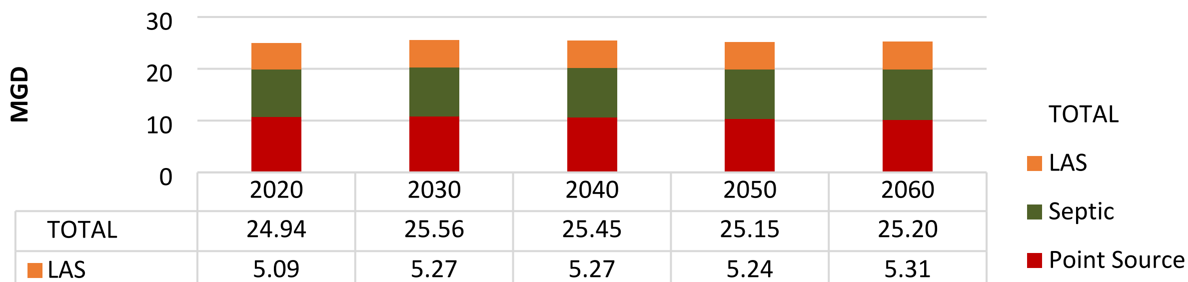
Source: Black and Veatch., 2017, Upper Flint Water Planning Region: Water and Wastewater Forecasting Technical Memorandum, 8 p., https://waterplanning.georgia.gov/document/publication/water-and-wastewater-forecasting-technical-memorandum-upper-flint /download.

4.1.2 Municipal Wastewater Forecasts

Wastewater may be treated by one of three disposal systems: municipal wastewater treatment plant to point source discharge, municipal wastewater treatment to land application system, or onsite sanitary sewage system, also called septic systems. Average daily discharge flows for 2019 were utilized for forecasting future municipal wastewater flows by county. The ratio of point source flows to land application system flows was generally held proportionate to the 2019 flow conditions. Manual adjustments were made where information was available on future facility flows. Any known (permitted) facility expansion plans were also taken into account. To calculate the projected wastewater flow to be treated by septic systems, the percent served by septic systems was multiplied by the county population then multiplied by the per capita use of 75 gallons per capita per day (gpcd) multiplied by 80-percent indoor water use return ratio. Further detail can be found in the forecasting technical memorandum, which is cited above and can be found on the Regional Water Planning website.

The resulting municipal wastewater forecasts project that the demand for municipal wastewater treatment in the Upper Flint Water Planning Region is expected to increase from 24.94 mgd in 2020 to 25.2 mgd in 2060. Disposal of treated wastewater is estimated to be 20% by land application systems, 43% by systems with point source discharges, and 37% by septic systems in 2020. In 2060, disposal of treated wastewater is forecasted to be 21% by land application systems, 40% by systems with point source discharges, and 39% by septic systems in 2060. Figure 4-2 illustrates the total municipal wastewater demand separated by discharge method.

Figure 4-2: Total Municipal Wastewater Demand (AAD-MGD)



	2020	2030	2040	2050	2060
TOTAL	24.94	25.56	25.45	25.15	25.20
LAS	5.09	5.27	5.27	5.24	5.31
Septic	9.12	9.49	9.58	9.59	9.73
Point Source	10.73	10.8	10.6	10.32	10.16

Source: Black and Veatch., 2017, Upper Flint Water Planning Region: Water and Wastewater Forecasting Technical Memorandum, 8 p., https://waterplanning.georgia.gov/document/publication/water-and-wastewater-forecasting-technical-memorandum-upper-flint /download.

4.2 Industrial Forecasts

Industrial water and wastewater forecasts anticipate the future needs for industries in this water planning region. Industries require water for use in their production processes, sanitation, cooling, as well as employee use and consumption. The forecasts presented in this section are based upon the 10-year average withdrawals from 2010 to 2019 and inputs of relevant industry trade groups within the state. The industrial forecasts include major industrial water users and wastewater generators that supply their own water and/or treat their own wastewater. Some industries rely on municipal systems for water supply and wastewater treatment. Where data were available, municipally supplied or treated industrial water use was included in the industrial water and wastewater forecasts. Other municipally-served industrial users, generally with lesser demands, were accounted for in the municipal forecasts. Forecast demand summary graphs (Figures 4-2 and 4-3) shown in section 4.5 reflect sector water use by supply source. Further detail can be found in the industrial forecasting technical memorandum[5].

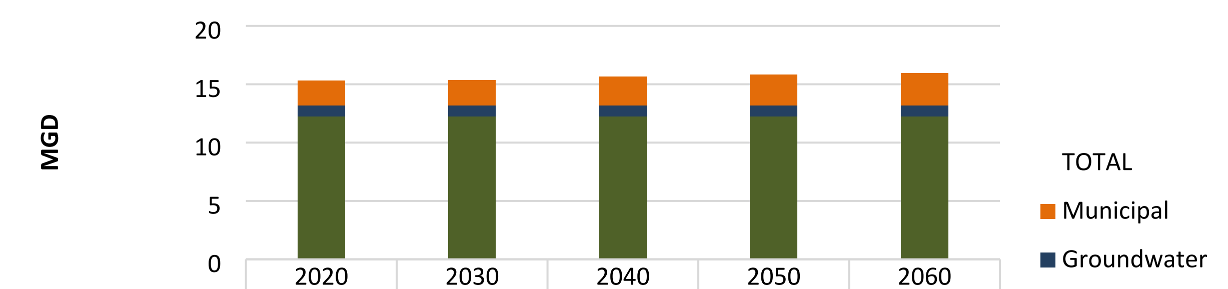
4.2.1 Industrial Water Forecasts

Industrial demand for water in the Upper Flint Water Planning Region is forecasted to increase from 15.31 mgd in 2020 to 15.95 mgd in 2060 with 93% from surface water and 7% from

[5] More information regarding Industrial Forecasts can be found on the Regional Water Planning website at: https://waterplanning.georgia.gov/forecasting/industrial-water-use

groundwater. Of this amount, municipally supplied industries account for 2.12 mgd in 2020 and 2.84 mgd in 2060. Figure 4-3 illustrates the total industrial water demand separated by source.

Figure 4-3: Total Industrial Water Demand Forecast (AAD-MGD)



	2020	2030	2040	2050	2060
TOTAL	15.31	15.37	15.67	15.85	15.95
Municipal	2.12	2.17	2.48	2.65	2.75
Groundwater	0.95	0.95	0.95	0.95	0.95
Surface Water	12.25	12.25	12.25	12.25	12.25

Source: Black and Veatch., 2017, Upper Flint Water Planning Region: Water and Wastewater Forecasting Technical Memorandum, 8 p., https://waterplanning.georgia.gov/document/publication/water-and-wastewater-forecasting-technical-memorandum-upper-flint /download.

4.2.2 Industrial Wastewater Forecasts

Industrial wastewater forecasts calculated based on facility wastewater permits reported discharge from 2015–2019. For some industrial facilities, water discharges may include stormwater runoff as well as the discharge of wastewater. Thus, permitted discharges may be a greater volume than permitted withdrawals, and reported discharges may vary with weather conditions from year to year. Information provided by industrial stakeholder groups was used to project future increases within a region or industry. Detailed information regarding the industrial wastewater forecasts can be found in the forecasting technical memoranda on the Regional Water Planning website.

The forecasts project that industrial wastewater treatment in the Upper Flint Water Planning Region will increase from 10.03 mgd in 2020 to 10.63 mgd in 2060. Of these amounts, 19% is expected to be treated by land application systems and 81% treated by systems with point source discharges in 2020. In 2060, 24% is expected to be treated by land application systems and 76% treated by systems with point source discharges. Figure 4-4 illustrates the total industrial wastewater demand separated by discharge method.

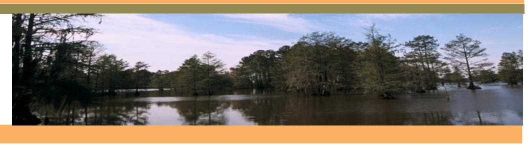
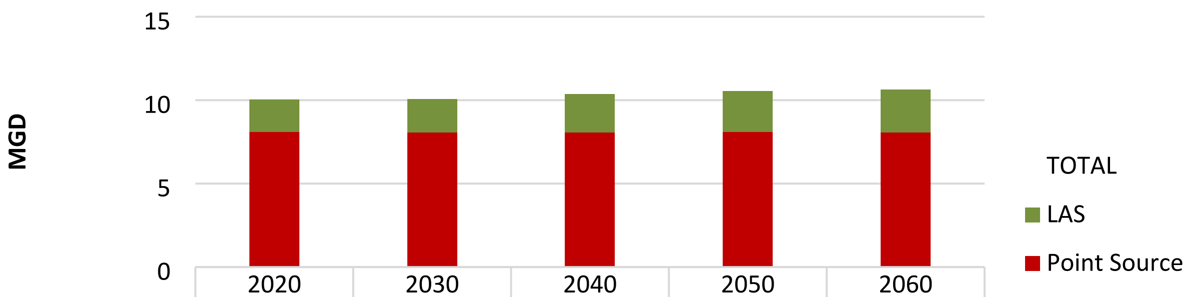


Figure 4-4: Total Industrial Wastewater Demand Forecast (AAD-MGD)



	2020	2030	2040	2050	2060
TOTAL	10.03	10.08	10.37	10.54	10.63
LAS	1.94	2.00	2.29	2.46	2.55
Point Source	8.09	8.08	8.08	8.08	8.08

Source: Black and Veatch., 2017, Upper Flint-Ochlockonee Water Planning Region: Water and Wastewater Forecasting Technical Memorandum, 8 p., https://waterplanning.georgia.gov/document/publication/water-and-wastewater-forecasting-technical-memorandum-upper-flint/download.

4.3 Agricultural Water Demand Forecasts

Agricultural water demands were prepared by the Georgia Water Planning & Policy Center at Albany State University (GWPPC), with support from the University of Georgia's College of Agricultural and Environmental Sciences. GWPPC was contracted by GAEPD to prepare estimates of water use by the agricultural sector in Georgia. The projections cover irrigation for row and orchard crops as well as most vegetable and specialty crops and account for more than 95% of Georgia's irrigated land. Additionally, estimates of current use were made for animal agriculture, horticultural nurseries and greenhouses.

Agricultural water demands were estimated in two different ways. First, current water use levels were estimated based on data collected from the Agricultural Water Metering Program administered by GAEPD. Second, estimates of current and forecasted use were made for the period 2020 to 2060 based on data on updated irrigated acreage, modeled crop water needs (informed by metering data), and economic models of future crop coverage.

With the agricultural water meter data, estimates of current agricultural demand were calculated from data collected from metered observations from the 2010 to 2019 growing seasons. Annual and monthly estimates were calculated and provided to members during the course of the plan review and revision process.

For the second method, agricultural irrigation water demand was projected for groundwater and surface water sources for the decades between 2020 and 2060. Each year's projection included five climatic scenarios ranging from very wet to very dry to simulate a range of weather conditions. Irrigated areas for each crop were projected from the baseline of year 2020 acres using economic models. Water withdrawal quantities were computed as the product of the projected irrigated area for a crop (acres), the predicted monthly irrigation application depth (inches), and the proportion of irrigation water derived from a source (fraction). For planning purposes, it was decided to use dry year values (75th percentile) for each water planning region since they represent a more conservative scenario than the normal (50th percentile) values.

In summary, the agricultural water use forecasts project that dry year agricultural water use in the Upper Flint Water Planning Region will increase by 39% from 2020 to 2060. The forecasts for agricultural water use in this water planning region by source type, as calculated using the second method described above, can be found in Table 4-2 below.

Table 4-2: Upper Flint Agricultural Water Demand Forecast (MGD)

Source	2020	2030	2040	2050	2060
Groundwater	158.08	171.82	187.33	194.09	225.96
Surface Water	47.70	50.73	53.81	66.76	61.15
Total	**205.78**	**222.55**	**241.14**	**260.85**	**287.11**

4.4 Thermoelectric Power Production Water Demand Forecasts

Water demands forecasts in this section estimate water requirements for thermoelectric power generation. Water requirements for hydropower generation are not included in the energy sector water demand forecast as these facilities are designed to pass water through and do not entail consumptive use of water. Miscellaneous potable water demands associated with power generation facilities are included in the municipal water demand forecasts discussed in previous sections.

The forecasts for this sector address both water withdrawal requirements and water consumption. Information related to water withdrawals is an important consideration in planning for the water needed for energy production. Water consumption is important to consider in assessment of net impacts on instream flows. Many power facilities that withdraw large volumes of water also return large portions of those withdrawals to the sources from which they were withdrawn.

The following factors were updated for the revised forecasts for water demand for thermoelectric power: statewide energy demand; existing facilities; facilities under construction; planned and permitted new facilities; facilities recently or to be retired; and changes in generating configuration. The water withdrawal and consumptive use factors that were estimated for each generating configuration were maintained from the previous planning cycle. A full discussion of the statewide water demands forecast methodology for this sector is provided in Energy Water Demand Forecast Technical Memoranda[6].

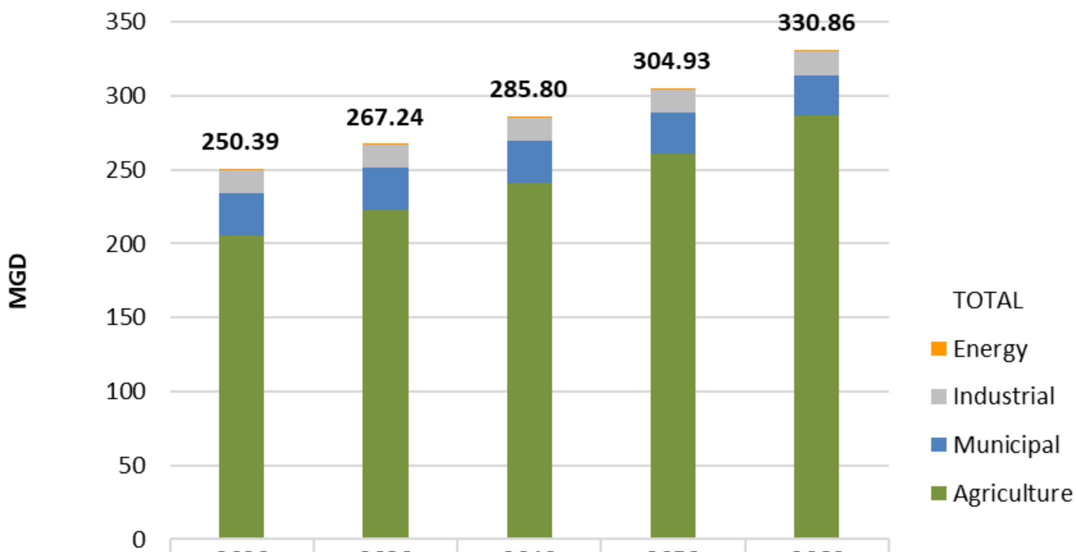
[6] More information regarding Energy Forecasts can be found on the Regional Water Planning website at: https://waterplanning.georgia.gov/forecasting/energy-water-use

In the Upper Flint Water Planning Region, there are two thermoelectric power facilities identified in the forecasts. The two facilities are Oglethorpe Power Talbot County Energy in Talbot County and Southern Power Plant Addison in Upson County, and the forecasts address the water needs for these facilities. The current withdrawal for these facilities in 2020 was 0.6 mgd. In 2060, water withdrawals are projected to be 0.96 mgd. Consumptive use by thermoelectric power facilities in the Upper Flint Water Planning Region is 0.53 mgd in 2020 and 0.84 mgd in 2060.

4.5 Total Water Demand Forecasts

In the Upper Flint Water Planning Region, estimated total water use is 250.39 mgd in 2020 and 330.86 mgd in 2060. As shown in Figure 4-5, agricultural water use accounts for the largest proportion of 2020 water use by a significant margin, and it is expected to continue to be the largest future water use in this water planning region. As shown in Figure 4-6, the forecasts project that wastewater flows in the region will increase from 35.04 mgd in 2020 to 35.95 mgd in 2060.

Figure 4-5: Total Water Demand Forecast (AAD-MGD)



	2020	2030	2040	2050	2060
TOTAL	250.39	267.24	285.80	304.93	330.86
Energy	0.60	0.60	0.79	0.87	0.96
Industrial	15.31	15.37	15.67	15.85	15.95
Municipal	28.70	28.72	28.20	27.36	26.84
Agriculture	205.78	222.55	241.14	260.85	287.11

Sources:

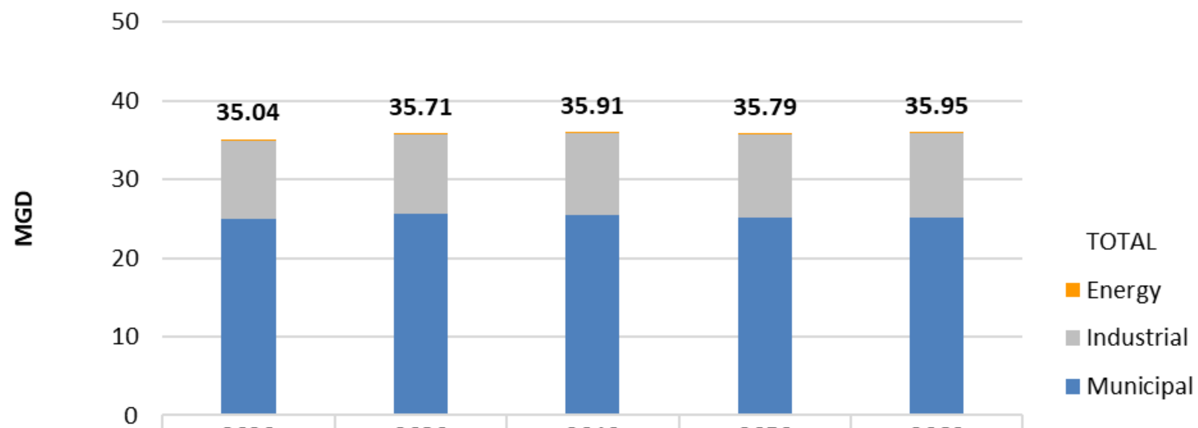
a) *Municipal Forecasting Methods Report (2022)*
- *https://waterplanning.georgia.gov/forecasting/municipal-water-use*

b) *Industrial Water Demand Forecast (2020)*
- *https://waterplanning.georgia.gov/forecasting/industrial-water-use*

c) *Energy Sector Water Demand Forecast (2020)*
- *https://waterplanning.georgia.gov/forecasting/energy-water-use*

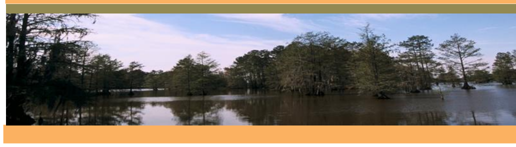
Notes: The total shown above includes estimated energy withdrawals as well as dry year agricultural demands (75th percentile demands). Values represent forecasted annual average demand (AAD) in million gallons per day (MGD)

Figure 4-6: Total Wastewater Demand Forecast (AAD-MGD)



	2020	2030	2040	2050	2060
TOTAL	35.04	35.71	35.91	35.79	35.95
Energy	0.07	0.07	0.09	0.1	0.12
Industrial	10.03	10.08	10.37	10.54	10.63
Municipal	24.94	25.56	25.45	25.15	25.20

*Notes: Values are totals for the entire water planning region, which includes portions of several watersheds. Conversion of mgd to cfs is cfs=mgd*1.5472.*



SUMMARY: This section discusses the results of the future resource assessments, which modeled how water resource capacities compare with future demands for water and wastewater treatment in the Upper Flint Water Planning region. It also discusses how the Upper Flint Water Planning Council considered potential gaps identified by the resource assessment models between needs and resource capacities.

Section 5. Comparison of Water Resource Capacities and Future Needs

This section discusses the results of the future surface water and groundwater resource assessments, which modeled how the forecasts of water and wastewater needs in the Upper Flint Water Planning Region (Section 4) compare with the capacities of the region's water resources. The results of the surface water availability, groundwater availability, and surface water quality resource assessments under future conditions are summarized in this section. The current conditions are described in Section 3.2. The model results provided the Upper Flint Water Planning Council with an evaluation of potential challenges in regional water or wastewater needs and resource capacities. They supported the Council in selecting appropriate management practices (Section 6) that will help the region to meet its future water needs, protect water resources, and meet the Council's vision and goals for this water planning region.

Where potential challenges were identified by the resource assessment models, the Council considered the potential adverse impacts – environmental, economic, and other impacts – of the potential challenges. Management practice selection to address potential challenges was guided by the Council's interpretation of the model results in the context of regional conditions, as well as by the Council's vision and goals for the region (see Section 1.3).

5.1 Future Surface Water Availability Assessment

The surface water availability resource assessment models the response of surface water bodies to meeting current and forecasted consumptive water demands. The current conditions results were described in Section 3.2.1, along with the approach and metrics evaluated by the BEAM model. This section covers the future conditions assessed by the BEAM model using two scenarios for evaluation. In this planning cycle, the following future scenarios were evaluated:

- Forecast (ag constant): 2060 water and wastewater needs with agricultural water demands held constant at baseline levels (average use for 2010-2018)
- Forecast (ag growth): 2060 water and wastewater needs with agricultural water deamnds set to 2060 forecast levels

The first scenario holds agricultural water demands at baseline levels as a result of uncertainty over future agricultural water demands in the region. Currently, agricultural water use from surface water sources and from the Floridan Aquifer in Subarea 4 of the Dougherty Plain is subject to a permit moratorium.[1] The moratorium currently limits increases in agricultural water demands in the region. While the moratorium may not continue for the full forecast period and does not affect all sources of water use in the region, it could dampen the projected increases forecasted for agricutlural water demands. These two scenarios provide the Council with results that bookend the range of potential change in forecasted agricultural use in the region from no increase to the full forecasted increase. The agricultural growth scenario is based on the forecasts which do not account for the current moratorium.

The assessment model evaluates surface water availability over the same model period used with the current conditions scenarios: 1939-2018. Therefore, all of the scenarios were subjected to the same climatic conditions. The results for the current and future scenarios for the water facilities include specific results for the scenarios under the climatic conditions of the 2007-2008 and 2011-2012 droughts.

The future surface water availabilty results are presented for the same river basins (Apalachicola-Chattahoochee-Flint Basins) and the same metrics (see Table 3.1) assessed for current conditions (discussed in Section 3.2.1).[2] The evaluation of water availability for water and wastewater facilities in the ACF Basin part of the region indicated challenges at seven water facilities (municipal and industrial) and eleven wastewater facilities (all municipal). Table 3-2 in Section 3.2.1 summarizes these results. All challenges observed in the assessment results for the current were also observed for the future scenarios.

Table 5-1 describes the future conditions assessment results for the seven facilities where water supply challenges in the region were observed. The results for the future scenarios were similar to those for the current scenarios, especially in terms of percentage of days during the modeled period where water supply challeges were identified. Table 5-2 summarizes the results for the 11 facilities where flows fell below the 7Q10 flow at some time(s) during the 80-year model period. Most of these low flow periods would not be considered to result in substantial wastewater assimilation challenges, as the percent of time that the instream flow fell below the 7Q10 value is less than 10%. At Byromville Water Pollution Control Plant, the percent of time exceeds 10% and indicates a wastewater assimilation challenge. Additionally, Table 5-2 lists one facility that is in the Flint River Basin but located in the Upper Ocmulgee Water Planning Region. This facility is not included in the count of facilities in the region with challenge in Table 3-2, but it is included here to support inter-council coordination. The challenge indicated for this facility is not considered to be substantial. The future scenario results indciated similar results to that observed for 2020 conditions (Table 3-4). The level of similarity is especially close for the Baseline 2020 and Future Ag Constant scenarios. The similarity of results for these two scenarios is not surprising, given that agricultural water demand is the same in both scenarios (average demands for 2010-2018). While the Future Ag Constant scenario includes non-agricultural demands, these uses are small relative to agricultural demands in this region.

[1] Figure 3-10 is a map of the moratorium area.

[2] As described in Section 3, small portions of the Upper Flint Water Planning Region occur in the Ocmulgee and Suwannee River Basins. Results for these basins are not included in this Plan but can be found in the Regional Water Plan for the Middle Ocmulgee and Suwannee-Satilla Water Planning Councils. The Upper Flint Water Planning Council will continue to communicate with the Middle Ocmulgee and Suwannee-Satilla Water Planning Councils in evaluating assessment results to support coordination in their respective Regional Water Plans.

Table 5-1: Future Scenario Water Supply Challenges Indicated in Assessment Results

Facility	Metric		Scenario: Forecast (ag constant)	Scenario: Forecast (ag growth)
Covia Holdings Corp.	% Time		0.06%	0.05%
	Shortage *million gallons*	Model Period	1.0	1.0
		2007-08 Drought	0	0
		2011-12 Drought	0	0
Southern Mills, Inc.	% Time		4.9%	4.9%
	Shortage *million gallons*	Model Period	283	283
		2007-08 Drought	38	38
		2011-12 Drought	61	61
Roosevelt Warm Springs Institute	% Time		1.2%	1.2%
	Shortage *million gallons*	Model Period	68	68
		2007-08 Drought	15	15
		2011-12 Drought	14	14
City of Warm Springs	% Time		0.3%	0.3%
	Shortage *million gallons*	Model Period	12	12
		2007-08 Drought	4	4
		2011-12 Drought	5	5
City of Manchester	% Time		9.5%	9.5%
	Shortage *million gallons*	Model Period	907	907
		2007-08 Drought	100	100
		2011-12 Drought	129	129
City of Thomaston	% Time		2.5%	2.3%
	Shortage *million gallons*	Model Period	816	738
		2007-08 Drought	202	189
		2011-12 Drought	146	142
Covia Financial Corporation	% Time		0.1%	0.1%
	Shortage *million gallons*	Model Period	10	10
		2007-08 Drought	0	0
		2011-12 Drought	0	0

**% Time is calculated as a proportion of the full model period (1939-2018). Shortage is total volume for full model period or for the drought period indicated. Each drought period includes the full two years listed.*

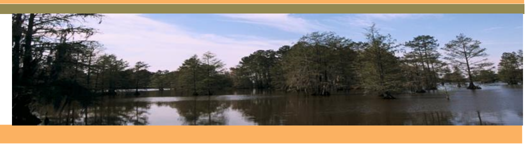


Table 5-2: Wastewater Assimilation Challenges Indicated in Assessment Results

Facility	% Time Flow Below 7Q10*		Required Flow (7Q10) *cfs*
	Forecast (ag constant) Scenario	**Forecast (ag growth) Scenario**	
Concord: South WPCP	2.5%	2.3%	3.76
City of Warm Springs WPCP	1.6%	1.6%	0.64
Thomaston: Bell Creek WPCP	1.6%	1.5%	13.47
Reynolds WPCP	1.1%	1.2%	33.39
Taylor City: Plant Laurel WPCP	0.3%	0.3%	4.86
City of Oglethorpe	0%	0%	328.1
Byromville WPCP	8.4%	18.2%	2.85
Cordele: Gum Creek WPCP	2.6%	4.8%	2.56
Ellaville WPCP-1 (GA0050105)	0.05%	0.1%	0.03
Ellaville WPCP-2 (GA0047767)	0.7%	1.1%	10.54
Ellaville WPCP-3 (GA0020931)	0.0%	0.00%	0.11
Additional Facility in Flint River Basin in the Middle Ocmulgee Region			
City of Griffin, Potato Creek	0.19%	0.19%	0.57

**% Time is calculated as a proportion of the full model period (1939-2018).*
WPCP: Water Pollution Control Plant
[Shortage volumes removed from this table per input from GAPED.]

In some cases, the Future Ag Constant scenario shows improved results over the Baseline scenario. These results are location specific and can result when upstream consumptive use decreases. Because some municipal systems in the region source water from groundwater and return treated wastewater to surface water, increases in water use by these systems can result in net decreases in total consumptive use of surface water.

Table 5-3 summarizes the results of the assessment for streamflow at Carsonville in the Upper Flint River Basin. These results address the occurrence and severity of low flows and recreational flows. The 2060 future scenario results were very similar to the 2020 current condition results in Section 3.2.1. The future results indicate that low flow periods occur similarly under the Ag Constant scenario relative to the Ag Growth scenario. Streamflow results for the baseline scenarios are presented in Table 3-5 from Section 3.2.1. In general, the current conditions had the most severe results for the 100 cfs metric, while the future conditions had the most severe results for the 600 cfs metric. The Baseline Drought scenario applied water demand conditions from the 2011 drought year throughout the model period. Agricultural water demands in the baseline drought scenario are approximately 90th percentile demands and account for most of the water use in the scenario. In the Future Ag Growth scenario, agricultural water demands are assumed to be 75th percentile demands, which reflects use in a dry year but not a severe drought, like that observed in 2011.

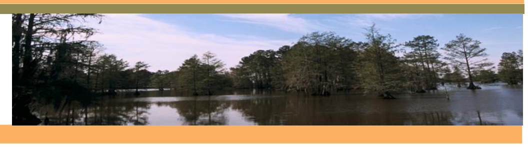
Table 5-3: Surface Water Availability Streamflow Results

Carsonville Flow Summary	Streamflow Metric *cfs*	Scenario	
		Forecast (ag constant)	**Forecast (ag growth)**
% Time Below Streamflow Metric	100	0.67%	0.64%
	600	24.2%	24.2%
**% Time is for calculated as a proportion of the full model period (1939-2018).*			

5.2 Future Groundwater Availability Assessment

This section compares ***2060 forecasted demand,*** presented in Section 4***,*** with the estimated sustainable yield range for the assessed aquifers. See Section 3.2.2 for a comparison of ***current*** use with the estimated sustainable yield and a description of the assessment approach. This section concludes with a discussion of a special assessment of expanded deep aquifer use in the region to inform implementation of Management Practice SF-3.

As discussed in Section 3.2.2., an aquifer is not necessarily exhausted by aquifer use when use exceeds the estimated sustainable yield range. Instead, exceedances indicate a possible need for additional information or instances where management practices may help to address potential impacts. Additionally, while the resource assessment results provide a broad overview of the aquifer, interpretation of the results must also consider that aquifer conditions and impacts are highly site specific. The Council considered these results in selecting the Management Practices and Recommendations to the State (see Sections 6.2 and 6.3).



Future Groundwater Availability Results

Results from the 2060 forecasts of aquifer demand for the three assessed aquifers are summarized in Tables 5-4 to 5-8. The results from the assessment for the Claiborne Aquifer include additional county-level forecasts (Table 5-9). More detail on the methods and results of the groundwater availability resource assessment can be found in the Synopsis Report: Groundwater Availability Assessment (GAEPD, 2010) and Synopsis Report – Groundwater Availability Assessment Updates (GAEPD, 2017), both of which are available on the state water planning website. The estimates in these tables are provided at two scales: (1) demand that occurs in the portion of the assessed aquifer that is within this water planning region, and (2) aquifer-wide demand that occurs in the full assessed area of the aquifer (illustrated on the maps in Figures 3-8, 3-9, and 3-12 through 3-14).

Floridan Aquifer Results

As described in Section 3.2.2, the Floridan Aquifer was assessed in two areas that occur in the Upper Flint Region: South-Central Georgia and the Dougherty Plain (see Figures 3-8 and 3-9). The Dougherty Plain assessment incorporates an additional model to estimate the impacts on baseflow more precisely for this part of the aquifer (Section 3.2.2).

For the South-Central Georgia part of the aquifer, demand that occurs in the Upper Flint Region is forecasted to increase by 9 mgd from 25 mgd in 2020 to 34 mgd in 2060 (Table 5-4). Across the full area of the South-Central Georgia portion of the Floridan Aquifer, demand is forecasted to increase from 488 mgd in 2020 to 658 mgd in 2060. With this increase, 2060 demand will exceed the low-end but not the high-end of the estimated sustainable yield range of 622 – 836 mgd. This result indicates that the location of future withdrawals will be important to overall impacts to the aquifer.

In the Dougherty Plain portion of the aquifer, where the aquifer is closely connected with surface water, 2060 forecasted aquifer wide demands will exceed the high-end sustainable yield (Table 5-5). As discussed in Section 3.2.2, the sustainable yield for this aquifer was estimated based on the potential impact of groundwater withdrawals on groundwater contributions to stream baseflows and not on impacts to the aquifer itself. The lack of a true confining unit above the Floridan in this region means the primary concern is the reduction in baseflow to rivers and streams. The aquifer and surface water system are highly interconnected in this part of the aquifer (see discussion in Section 3.2.2).

Table 5-4: Floridan Aquifer: South Central Georgia – Sustainable Yield and Forecasted 2060 Water Demands

Estimated Sustainable Yield Range	Forecasted 2060 Demands	
	Upper Flint Region	Aquifer-Wide
622 to 836 mgd	34 mgd	658 mgd

Table 5-5: Floridan Aquifer: Dougherty Plain – Forecasted 2060 Water Demands

Estimated Sustainable Yield Range	Forecasted 2060 Demands	
	Upper Flint Region	Aquifer-Wide
237 to 328 mgd	34 mgd	576 mgd

At a broad scale, the results for the Dougherty Plain point to concern over use of this aquifer, but the Council notes the importance of existing policy in managing use of this aquifer. Since 2012, there has been a moratorium on new withdrawals from the Floridan Aquifer in the Dougherty Plain (see Figure 3-10 in Section 3.2.2.). Prior to the moratorium, and if the moratorium is lifted, withdrawals from the aquifer are managed per the 2006 Flint River Basin Plan, which sets geographic zones (restricted use, capacity use, and conservation use) that manage aquifer withdrawals based on potential impacts on streamflow (see Figure 3-11 in Section 3.2.2). Therefore, these results were considered in the context of existing policy and together with those observed in the surface water availability resource assessment as the Council developed its Management Practices and Recommendations to the State.[3] Specifically, no new agricultural withdrawals from the Floridan aquifer are permitted at this time in areas that are modeled to have the greatest impact on streamflow.

The Council also notes that the sustainable yield metric exceeded as part of the groundwater resource assessment, potential impact to baseflow, is not indicative of overall aquifer health and resiliency. Because of the interconnected nature of the Floridan aquifer and the surface water sources in this area, drawdowns in the aquifer in areas that interact a stream will generally result in streamflows replenishing the aquifer. When aquifer drawdown occurs in this part of the Floridan Aquifer, the aquifer will draw from its storage and once the aquifer level drops below the bottom level of the nearest surface water body (under current use or increased withdrawals), the aquifer will be replenished by that surface water body.

Cretaceous Aquifer Results

The forecasted 2060 demands (72 mgd) increase by 21 mgd compared with current 2020 use for assessed areas of the Cretaceous Aquifer. Table 5-6 shows the sustainable yield and forecasted demands for a large area of the aquifer from Macon to Augusta (approximately from Macon County to the South Carolina state line). Table 5-7 shows the sustainable yield and forecasted demands for a more focused analysis of the aquifer wtihin the Upper Flint region. At the larger scale, foreasted 2060 demands are below the low end of the sustainable yield range for this aquifer. At the more focused scale, in the Upper Flint Region, forecasted 2060 demands are within the sustainable yields range (beteween low and high end). The latter result indicates that the potential for adverse impacts of increased use of this aquifer in this region will be location specific.

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[3] As noted in Section 3.2.2, for analysis of sustainable yield for the Upper Floridan Aquifer in the Dougherty Plain, changes in baseflow to streams were evaluated on a reach-by-reach basis, which is a relatively conservative approach to the analysis.

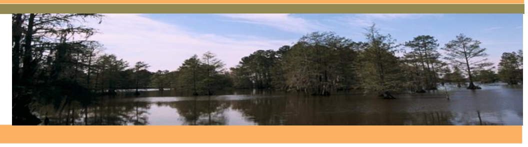


Table 5-6: Cretaceous Aquifer Between Macon and Augusta – Forecasted 2060 Water Demands

Estimated Sustainable Yield Range	Forecasted 2060 Demands	
	Upper Flint Region	Aquifer-Wide
347 to 445 mgd	72 mgd	227 mgd

Table 5-7: Cretaceous Aquifer: Upper Flint Region – Forecasted 2060 Water Demands

Estimated Sustainable Yield Range for Upper Flint Region	Forecasted 2060 Demands Upper Flint Region
50 to 201 mgd	72 mgd

Claiborne Aquifer Results

The forecasted 2060 demand results for the Claiborne Aquifer (77 mgd) represent an increase of 21 mgd relative to the 2020 current use (55 mgd). As indicated in Table 5-8, these forecasted results remain below the low-end of the estimated sustainable yield range for the Claiborne Aquifer. Table 5-9 includes county level estimates of sustainable yield and forecasted 2060 demands from the Claiborne Aquifer. These results indicate available sustainable yield across the region for this aquifer. However, as with any aquifer the potential for adverse impacts will be dependent on the location and concentration of withdrawals. Some areas may support increased use sustainably, while other parts may be more likely to experience potential adverse impacts of increased use. The next section describes an analysis of increased use of the Claiborne Aquifer that considers transient demands which vary over the course of the year with the agricultural growing season.

Table 5-8: Claiborne Aquifer – Forecasted 2060 Water Demands

Estimated Sustainable Yield Range	Forecasted 2060 Demands	
	Upper Flint Region	Aquifer-Wide
141 to 803 mgd	77 mgd	94 mgd

Table 5-9: Claiborne Aquifer – High-End of Sustainable Yield for the Counties in the Upper Flint Region

County	Forecasted 2060 Demands *mgd*	High-End Sustainable Yield *mgd*
Crisp	10.5	37.4
Dooly	20.4	83.1
Macon	0.8	34.7
Marion	0	1.2
Schley	0.1	16.6
Sumter	36.8	116.5
Webster	0.1	41.1

Additional Assessment of Claiborne and Cretaceous Aquifers

Management Practice SF-2 supports evaluation and implementation of alternative groundwater sources to replace surface water withdrawals in the region during drought periods to reduce adverse impacts to surface water flows. As a part of this recommendation, the Council emphasizes the need for more information on the condition of these aquifers to support better understanding of their sustainable yields.

The assessment of the Claiborne and Cretaceous Aquifers was extended with an initial analysis of the response of these aquifers to increased time-varying withdrawals during peak usage (agricultural growing season) and during non-use (winter months). The analysis evaluated response of these aquifers to increasing levels of use. This additional assessment was conducted to inform the Council about the potential response of these aquifers to increased use that may result with implementation of Management Practice SF-3. This assessment focused on simulating potential increased withdrawals from these aquifers where they are confined. Where the aquifers are unconfined, they are most directly in contact with the surface water streams and any drawdowns would more directly impact the groundwater contribution to stream baseflow.

Claiborne Aquifer Results: When use levels were increased to two times the baseline pumping level, the 30-foot drawdown threshold was during the peak growing season in Crisp and Dooly Counties. However, simulated Claiborne Aquifer levels recovered during periods of non-use, which indicates that the aquifer has the ability to sustainably handle the time-varying demand analyzed in this assessment.

Cretaceous Aquifer Results: The Cretaceous aquifer has a series of water-bearing units divided by confining layers. The predominant water-bearing units of the Cretaceous aquifer include (from shallowest to deepest): Providence Sand (model layer 5), Eutaw-Midville (model layer 6), and Upper/Lower Atkinson (model layer 7). For model layer 5, at baseline pumping levels during the peak growing season, the 30-foot drawdown metric was exceeded. Because this threshold was reached, no further assessment of model layer 5 was conducted. For model layer 6, the 30-foot drawdown threshold was exceeded when pumping was twice the baseline level during the peak growing season. The simulated groundwater levels for this aquifer layer did not fully recover during the non-growing season. Additional information is needed to better assess the potential use of this aquifer layer. Layer 7 was not assessed due to potential water-quality issues. There is limited information on the Cretaceous aquifer in this area of the State. Additional studies may be needed to better assess the capacity of these aquifer layers.

As discussed in Section 6, Management Practice SF-3 is currently being implemented through a new project funded in 2022 by a grant from the Governor's Office of Planning and Budget via allocations established from the American Recovery Plan Act for infrastructure development. This new project, a part of the GA-FIT program, will install over 200 new deep groundwater wells to provide an alternative supply source during drought at agricultural surface water withdrawal sites in the Flint River Basin. The analysis presented above provides an initial basis of information to support implementation of this practice, but important differences between the analysis and the GA-FIT implementation plans limit direct application of these results. GA-FIT will target a different geographic range. Furthermore, the new GA-FIT project plans to limit use of the new wells to during drought years, while this analysis evaluated increased aquifer use regardless of climatic conditions. Additional analysis that more closely matches the GA-FIT project plans will be more directly applicable and informative. Additional data collected through the monitoring component of the GA-FIT project will expand the information base for assessment and management of these aquifers.

5.3 Surface Water Quality Comparisons

In Section 3, Figure 3-5 shows the water quality model results regarding the availability of assimilative capacity under ***current*** conditions for flow and oxygen consuming wastes that affect levels of dissolved oxygen. This section shows water quality model results regarding the availability of assimilative capacity for oxygen-consuming wastes under ***future*** (2060) conditions. Assimilative capacity evaluates how DO levels compare to water quality standard of 5.0 mg/L (or natural conditions). For the future conditions modeling, areas that had shown limited or no assimilative capacity for dissolved oxygen in the current conditions modeling may need to be addressed. To do this, GAEPD incorporated some assumptions regarding 2060 permitted flows and modifications to permit effluent limits in future conditions modeling. Since GAEPD cannot issue permits that will violate water quality standards, GAEPD will continue to evaluate and modify future permit requests and adjust permit limits to avoid potential dissolved oxygen violations. The dissolved oxygen results under the updated future conditions for this plan update utilized conservative approach used to model results, including minimum instream flows and warm water temperatures.

Figure 5-1 shows the modeled assimilative capacity at assumed future (2060) permitted flow and effluent limits. Water quality model results indicate that while permit limits can address limitations on assimilative capacity, some streams are projected to experience increasing availability of assimilative capacity in the Flint River Basin as expected improvements in wastewater treatment are projected to improve available assimilative capacity under future conditions. The number of stream miles in the Flint River Basin where assimilative capacity is projected by the model to be exceeded or unavailable will decrease from 56 miles under current conditions to 0 miles by 2060, based on modeling assumptions.

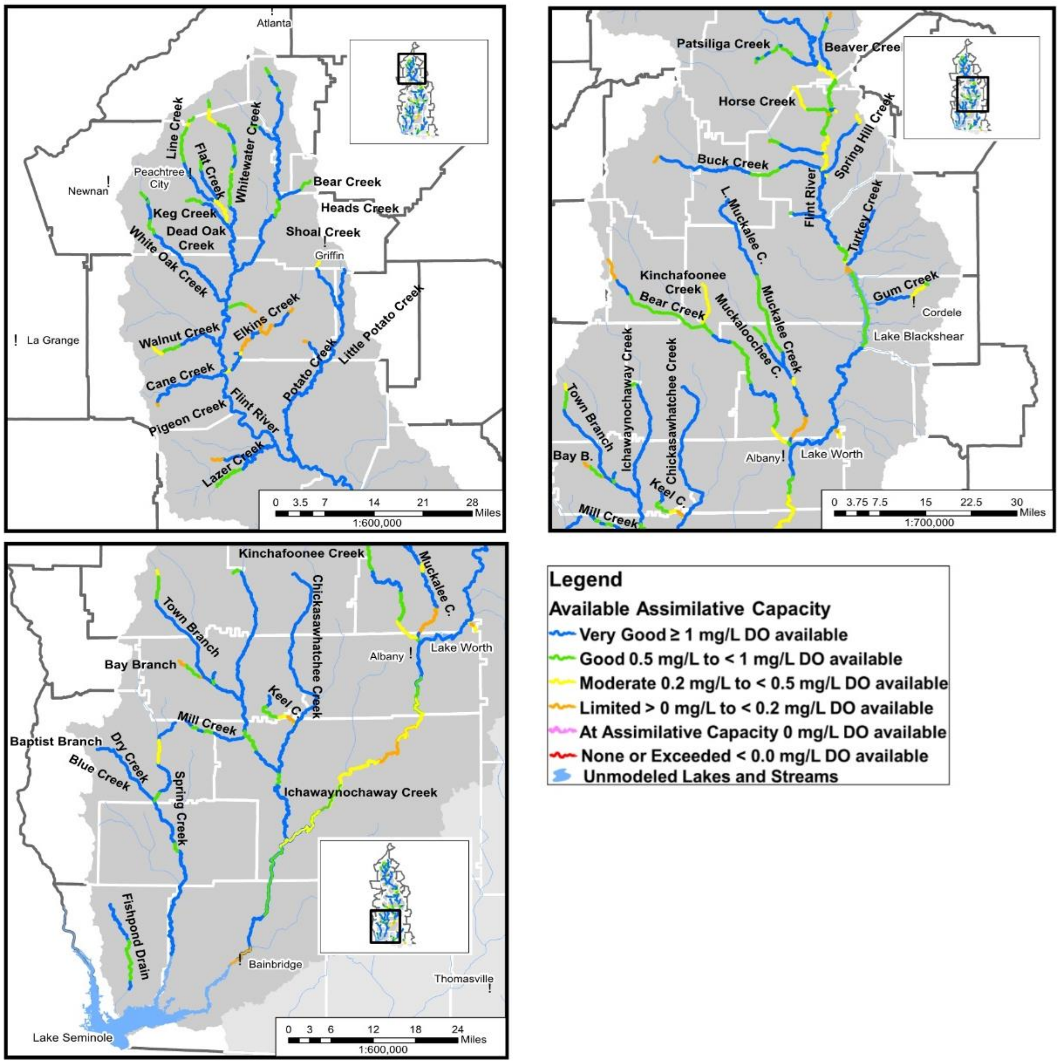
More information regarding the type of assumptions made under future conditions modeling is provided in the Synopsis Report, Assimilative Capacity Resource Assessment (July 2022), which is available on the state water planning website.

Watershed and lake models were developed at future (2050) conditions. The model results indicated that in the Flint River Basin, while nonpoint sources currently contribute more total nitrogen than point sources, future increases in total nitrogen loading will come more from point sources than nonpoint sources. The lake model results indicated that in Lake Blackshear, total phosphorus loading in the future will be primarily from point sources, as it is under current conditions. Downstream of the region, at the Florida border, the model results for Lake Seminole indicated that future increases in total nutrient loadings will be primarily point source related. As noted in Section 3.3, these lakes do not have established nutrient standards, and so, the lake model results cannot be compared against standards for these lakes. However, the model results are an indication of where management practices should be directed in order to control nutrient loading.

In its review of the models and their results, the Upper Flint Water Planning Council had several concerns about the model assumptions and inputs. See Section 7.4 for a recommendation related to the Council's concerns about the lake and watershed models.

Water quality is also assessed by compliance with state water quality standards. Impaired waters where water quality standards are not met are discussed in Section 3.3.1.

Figure 5-1: Assimilative Capacity Results from Dissolved Oxygen Assessment: Flint Basin (2050)



	Flint Basin-Available Assimilative Capacity (Total Mileage)					
Model Run	Very Good	Good	Moderate	Limited	At Assimilative Capacity	Exceeded
2060	712	229	102	43	0	0

Source: EPD, Synopsis Report – Surface Water Quality (Assimilative Capacity) Resource Assessment, July 2022.

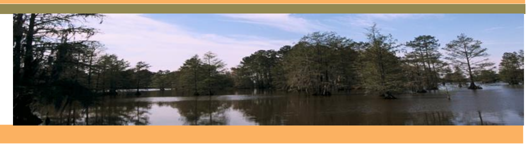
5.4 Summary of Future Resource Assessment Results

The resource assessment model results discussed in Section 3 and this section identified the following potential water resource management challenges in the Upper Flint Water Planning Region:

- The surface water availability assessment model identified moderate water supply and wastewater assimilation challenges under current use and forecasted 2060 demands in surface water availability in the Upper Flint region. The results indicated seven facilities with water supply challenges and ten facilities with wastewater assimilation challenges. The Council also reviewed streamflow results under current use and future demand scenarios at Carsonville on the Flint River.
- For groundwater, current use and forecasted 2060 demands for the Claiborne Aquifer are below the sustainable yield (low-end). For the Cretaceous Aquifer, current use and forecasted 2060 demands are within the sustainable yield range (between low-end and high-end) in a focused assessment of the aquifer within the Upper Flint Region. In the Floridan Aquifer, current use and forecasted 2060 demand is above the high end of the sustainable yield range. As noted in the discussion in this section, the Dougherty Plain results reflect impacts of groundwater use on streamflow and not direct impacts on aquifer health.
- Water quality model results indicated overall increasing availability of assimilative capacity in streams in the Flint River Basin due to assumed more stringent permit conditions where discharges increase in the future. However, some areas continue to model limited or exceeded availability of assimilative capacity under future conditions despite stringent permit conditions.

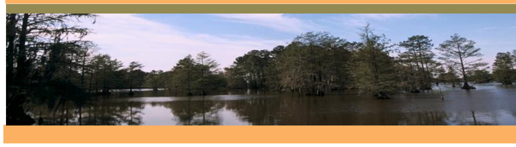
The Upper Flint Water Planning Council considered these potential challenges and their potential adverse impacts in this water planning region, including environmental, health, and economic. In order to meet the Council's vision and goals for the region and given the results considered in this section, the Council developed this Regional Water Plan to address the potential challenges identified by the resource assessment models as follows:

- *Surface water availability*: Challenges at specific facilities will be addressed by GAEPD in the permitting process. The assessment results indicate that drought conditions and future increases in water demands may result in more frequent occurrence of low flows in the region. Demand management, supply management, flow augmentation, and drought response practices are intended to address these flow challenges. Better information to support more thorough evaluation of resource capacity will continue to improve our ability to manage surface water availability effectively and sustainably in this region.
- *Groundwater availability*: Increased use of the Claiborne and Cretaceous Aquifers should be further evaluated in order to develop appropriate management strategies that address geographic and time-based variations in capacity and demands. This information will be particularly relevant in guiding implementation of Management Practice SF-3 through the new GA-FIT project in this region. The new project will also



improve our understanding of these aquifers through increased monitoring. In the Upper Floridan Aquifer in the Dougherty Plain, the impact of groundwater withdrawals on surface water flows in the Flint River Basin should continue to be a determining factor in guiding the location and amount of groundwater use from this aquifer. Existing policy is currently focused on limiting impacts to streamflow, and a moratorium currently restricts increased use of this part of the Floridan Aquifer. In general, better and more geographically specific information on groundwater resource capacity will improve our ability to evaluate aquifer use and management practices.

- *Surface water quality*: Implement practices targeted especially toward nonpoint source of pollutants to improve assimilative capacity and to reduce nutrient loading in the region's streams and lakes. It is expected that GAEPD will adjust point source discharge permit limits over time as needed to address assimilative capacity constraints and nutrient criteria. More nonpoint source controls may be needed to address nutrient criteria. Collect more complete information to support the targeting of management practices for water quality in the future.



SUMMARY: This section presents the water management practices recommended by the Upper Flint Water Planning Council to address potential water resource management challenges identified by the resource assessment models and to fulfill the Council's vision and goals.

Section 6. Addressing Water Needs and Regional Goals

6.1 Identifying Water Management Practices

The Upper Flint Water Planning Council considered the following as it selected management practices for this Regional Water Plan:

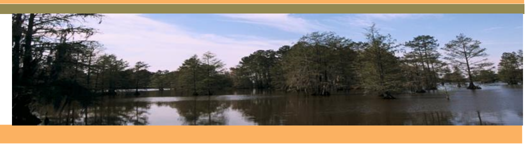
- Existing plans and practices
- Potential water resource management challenges identified by the comparison of resource needs and resource capacities (see Sections 3 and 5)
- Council's vision and goals (see Section 1)
- Public input
- Coordination with local governments, neighboring water planning councils, and the Metropolitan North Georgia Water Planning District

The Council's decision-making process to adopt management practices and recommendations was consensus-based, where possible, according to the Council's Operating Procedures and Rules for Meetings.[1] In cases where consensus could not be reached, decisions were approved by voting. In order to coordinate beyond the water planning region, Council members met with representatives of neighboring water planning councils and the Metropolitan North Georgia Water Planning District to discuss shared resources. In these meetings, the Council worked with its neighbors toward adoption of coordinated or complementary management practices. Within the region, the Council sought input from stakeholders and local governments through public outreach and provisions for public participation.

The Council identified uncertainties that could impact implementation of this Regional Water Plan, including:

- *Implementation of numeric nutrient criteria for Florida's lakes and flowing waters*: These water quality criteria have implications for water quality dischargers and other stakeholders in Georgia. As described in Section 2.3, at this time, Georgia is monitoring water quality and focused on the development of a nutrient strategy that may include

[1] These documents are available with the Council's Memorandum of Agreement on the Council's website.



point source discharge limits and nonpoint source management to address these criteria.[2]

- *Information needs to support improved water quality and quantity management:* The limits of available information constrain planning decisions, and the Upper Flint Water Planning Council has identified numerous information needs to support improved future planning and management. For more details on recommendations to address information needs, see Section 6.3.

Despite uncertainties, the Council proceeded with plan development based on the best information currently available. The Council intends that future revisions of this Plan will improve upon the current plan, when possible, as conditions change and new information becomes available, and better promote the attainment of the Council's vision and goals for this water planning region.

6.2 Selected Water Management Practices for the Upper Flint Water Planning Region

The management practices selected by the Council are summarized in Table 6-1. The table is organized by the type of practice: Demand Management (**DM**), Supply Management and Flow Augmentation (**SF**), Water Returns Management (**RM**), and Water Quality (**WQ**). Three management practices were selected by the Council as most important to fulfilling the Council's vision and goals and addressing potential water resource management challenges identified by consideration of the resource assessment models and forecasts of water and wastewater demands. These practices are marked as ***high priority management practices***. A discussion of the management practices follows the table.

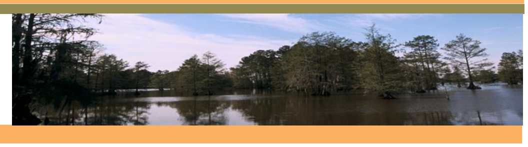
Table 6-1 includes details addressing implementation including responsible parties and implementation timeframes. Short-term practices are those which will be implemented or encouraged over the five-year timeframe leading up to the next update of this Plan. Long-term management practices vary in duration and scope and will require further study and development to define time requirements.

[2] More information on Florida's nutrient criteria is available on-line: https://floridadep.gov/dear/water-quality-standards/content/numeric-nutrient-criteria-development. Georgia's Plan for the Adoption of Water Quality Standards for Nutrients can be found here: https://epd.georgia.gov/document/publication/ganutrientcriteriaplanaug2013revpdf/download

Table 6-1: Water Management Practices Selected for the Upper Flint Water Planning Region

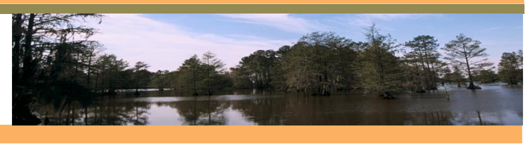
WATER MANAGEMENT PRACTICES		
Demand Management (DM)		
Issues Addressed	Surface water and groundwater availability	
Council Goals Addressed	1, 3, 4, 5, 6	
DM1: Maintain the agricultural water withdrawal metering program		
• Many improvements have been made in the agricultural water withdrawal meter program in the past several years. This program provides valuable data that informs management at the individual, regional, and state levels. • The Council recommends continued implementation of the agricultural water metering program to ensure that the data collected is as comprehensive, accurate, and useful as possible. Maintenance of this program requires inspections, maintenance, repair, and replacement to ensure functioning meters. Additional data collection, on a voluntary basis, would enhance information available to support management and planning. • The Council recommends continued investment by the state in the metering program for maintenance of this program. • The Council also recommends that the program continue to provide annual reporting to the public on collected data (while recognizing the confidentiality constraints on the use of the data). • Reporting on collected data to water users and the public (summary values to protect individual identities for public reporting) is important to supporting public education and water resources planning and management.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Seek adequate funding for completion of comprehensive meter installation and maintenance Continue and improve meter program implementation, data collection, and reporting		GAEPD General Assembly
DM2: Implement non-farm water conservation practices in the Upper Flint Water Planning Region		
State laws and regulations require water conservation practices that address many water uses in this region, including: municipal water supply, industrial water use, landscape irrigation, and car washes. Building code requirements address high efficiency plumbing fixtures, high efficiency cooling towers, and submetering for multi-unit residential buildings and some industrial facilities. Water loss auditing requirements for public water systems are also required. Compliance with these requirements is important to responsible management of water availability in the region. Beyond these requirements, the Council supports and encourages the adoption of voluntary water conservation measures. The Water Conservation Implementation Plan provides guidance to Georgia's seven major water use sectors on water conservation measures that can be adopted by water users.[3]		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**

[3] Water Conservation Implementation Plan: https://epd.georgia.gov/document/publication/georgias-water-conservation-implementation-plan-mar-2010/download



WATER MANAGEMENT PRACTICES		
Continue compliance with and implementation and enforcement of regulations (on-going) Implement voluntary water conservation measures (on-going)		GAEPD Surface water and groundwater withdrawal permittees
DM3: Encourage all water providers to implement education and outreach programs		
Raise awareness about the value of local water resources and the need to conserve; empower individuals and businesses to make informed decisions about their water using behavior and the fixtures and appliances they employ.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Create and deliver public awareness programs to support demand management objectives (on-going)		Municipal surface water and groundwater withdrawal permittees
DM4: Implement agricultural water conservation practices in the Upper Flint Water Planning Region		
Agricultural water conservation practices required by existing law include compliance with the Flint River Basin Water Development and Conservation Plan as well as the Water Stewardship Act of 2010 regarding active, inactive, and unused permits. Agricultural irrigation efficiency requirements and compliance schedules set by 2014 amendments to the Flint River Drought Protection Act (OCGA 12-5-546.1) set efficiency standards to be attained by 2020. Additionally, the Council recommends the following as long-term efficiency benchmarks: • By January 2050, all irrigation systems will have application efficiencies of 90% or greater. • Under the Flint River Drought Protection Act, new withdrawal permits in the Flint River Basin should be required to implement advanced irrigation scheduling (e.g., soil moisture sensors, irrigation scheduling applications). Demonstrating compliance should not be burdensome and could rely on existing self-certification methods for existing efficiency requirements. A focus on a desired performance outcome supports increased conservation while allowing farmers to select what practices and approach works best for their own operations. Practices that farmers can use to attain efficiency benchmarks include low-pressure/full-drop nozzle irrigation systems, Variable Rate Irrigation, conservation tillage, irrigation scheduling, drip irrigation, soil moisture sensors, as well as other conservation measures not listed here that best suit an individual farmer's operation.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Continue compliance with and implementation and enforcement of rules (on-going) Continue implementation of existing incentive programs and evaluate the need for new incentive programs (on-going) Expand Flint River Drought Protection Act rules to require advanced irrigation scheduling for new withdrawal permits, as described above Attain benchmarks set for 2020 and 2050 (see Tables 6-1 and 8-1)		Agricultural irrigators Georgia Soil and Water Conservation Commission (GSWCC) Soil and Water Conservation Districts Natural Resources Conservation Service (NRCS) GAEPD GADNR Board

WATER MANAGEMENT PRACTICES		
DM5: Implement voluntary agricultural water conservation practices in the Upper Flint Water Planning Region with the support of incentive programs		
Various programs to incentivize adoption of agricultural water conservation measures exist through the USDA Natural Resource Conservation Service, Georgia Soil and Water Conservation Commission, and regional Soil and Water Conservation Districts. Funding for these programs should be allocated based on the priority resource concerns identified by local stakeholders and awarded to projects that provide the most benefit to our water resources. Technical assistance should be provided, and compliance paperwork streamlined to encourage participation among producers and land owners.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Continue compliance with and implementation and enforcement of rules (on-going) Continue implementation of existing incentive programs and evaluate the need for new incentive programs (on-going) Attain benchmarks set for 2020 and 2050 (see Tables 6-1 and 8-1)		Agricultural irrigators Soil and Water Conservation Districts NRCS GSWCC GAEPD
DM6: Manage agricultural water withdrawal permits in the Flint River Basin according to state regulations based on the 2006 Flint River Basin Water Development and Conservation Plan and other applicable state regulations and policy		
At this time, there is a moratorium on new or expanded agricultural surface water withdrawal permits in the Lower Flint River Basin and groundwater withdrawal permits in Subarea 4 of the Upper Floridan Aquifer in the Dougherty Plain. If the moratorium is lifted (or partially lifted), new and expanded permits should continue to be subject to the conservation in existing law and regulations based on the 2006 Flint River Basin Water Development and Conservation Plan and the 2014 amendments to the Flint River Drought Protection Act. The 2006 plan limited new agricultural withdrawal permits based upon expected impact on nearby wells and streams. The 2006 plan applied the following requirements to new agricultural water withdrawal permits in the Flint River Basin: • New permits require mandatory conservation measures, such as end-gun shut off switches and leak prevention and repair, as a condition of the permit. • New surface water permits in Ichawaynochaway and Spring Creek sub-basins must suspend use when streamflow drops below 25% Average Annual Discharge instead of 7Q10. • New permits in the Flint River Basin require a $250 application fee and are valid for 25 years. The 2014 amendments to the Flint River Drought Protection Act require all irrigation systems in the Flint River Basin to meet efficiency requirements (OCGA § 12-5-546.1). Management practice DM4 recommends enhanced efficiency and conservation requirements for agricultural withdrawals in the Flint River Basin.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Continue implementation of Flint River Basin Water Development and Conservation Plan (2006) and other applicable regulations		GAEPD Agricultural surface water and groundwater withdrawal permittees
DM7: Create an awards program to recognize agricultural irrigators for exemplary implementation of best management practices (BMPs) for water conservation		



WATER MANAGEMENT PRACTICES		
This program should be coordinated with existing Georgia Soil and Water Conservation Commission programs.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Initiate awards program by next planning cycle (five years)	Continue to implement awards program annually	GSWCC Georgia Department of Agriculture Soil and Water Conservation Districts Universities Agricultural commodity groups GAEPD
Supply Management and Flow Augmentation (SF)		
Issues Addressed	Surface water and groundwater availability	
Council Goals Addressed	1, 2, 3, 4, 5	
SF1: Evaluate storage options in the Upper Flint River Basin that can provide for supply and flow augmentation in dry periods		
• The Council recommends creation of a study commission to evaluate storage options within the Upper Flint River Basin. A full range of storage and reservoir options should be evaluated, including farm ponds (see SF4) and inactive quarry sites, which have been used elsewhere to provide water storage capacity. The study commission's evaluation should assess potential locations, viability, cost, and implementation. Costs should be evaluated in terms of potential in-stream water resource benefits, as well as other benefits. Locations should be evaluated in terms of providing smaller, but more frequent, possibilities for storage options throughout the region and State. • The Council recognizes that new storage options are a long-term goal and encourages the development of water storage for the benefit of current and future generations.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Identify funding for evaluation and establish study commission and report to Council and policymakers by next planning cycle (pending availability of funding)	Implement recommendations of study commission	Council Neighboring councils GAEPD University researchers Consulting firms Georgia Environmental Finance Authority (GEFA)
SF2: Evaluate streamflow augmentation via direct pumping from aquifers to mitigate adverse impacts to in-stream flows in dry periods		
• In dry periods, streamflow might be augmented through direct pumping of groundwater into surface water streams. Streamflow augmentation can mitigate impacts during dry periods that have the potential to harm endangered and threatened freshwater mussels. • Several factors could limit the potential use of this practice, including: groundwater yields, water quality, cost, aquifer impacts, and streamflow impacts of aquifer pumping. • A pilot project for streamflow augmentation is being implemented on Spring Creek near Colquitt Lower Flint River Basin. The GA-FIT project described in Management Practice SF3 will make repairs to this project and potentially seek to establish an additional augmentation		

<table>
<tr><th colspan="3">WATER MANAGEMENT PRACTICES</th></tr>
<tr><td colspan="3">pilot project site in the region. Continued evaluation of this project should inform future implementation of this management practice.
• The Flint River Drought Protection Act addresses the conservation of flows from state funded augmentation projects and require notifications of downstream water withdrawal permittees regarding preservation of such flows (OCGA § 12-5-546.2).</td></tr>
<tr><td>Short-Term Actions</td><td>Long-Term Actions</td><td>Responsible Parties</td></tr>
<tr><td>Continue to evaluate pilot project implementation
Identify funding sources to support practice if feasibility study is favorable</td><td>Expand implementation if further favorable results are observed (pending availability of funding)</td><td>University researchers
GADNR
GAEPD</td></tr>
<tr><td colspan="3">SF3: Develop groundwater source alternatives to replace surface water withdrawals during drought, where feasible</td></tr>
<tr><td colspan="3">• During drought, surface water withdrawals have a direct impact on streamflows that can be mitigated by switching to alternative sources. In this region, the groundwater resource assessment suggests that deeper aquifers (e.g., Claiborne, Cretaceous) may provide options for alternative sources with available sustainable yield to support water use during drought.
• Source switching can support increased in-stream flows during drought in some places in this water planning region.
• The Council recommends that this practice be implemented with incentives.
• The Council recognizes that environmental and financial factors may limit the implementation of this practice. However, the Council supports reducing pressure on in-stream flows through an emphasis on increased use of groundwater in the region – for new and existing withdrawals.
• The practice should only be used where it will not adversely impact environmental resources, especially groundwater. The resource assessment results indicate possible opportunities for application in the confined areas of the Claiborne and Cretaceous Aquifers, but the potential for site-specific and transient impacts requires further evaluation.
• This practice will be implemented in this region through a grant from the Governor's Office of Planning and Budget via allocations established from the American Recovery Plan Act for infrastructure in 2022 to a partnership of the Georgia Water Planning and Policy Center, the Georgia Environmental Protection Division, and the Golden Triangle Resource Conservation and Development Council. The project will be implemented as a part of the GA-FIT program. The grant aims to provide deep groundwater alternatives to surface water withdrawals for use during drought periods to irrigators throughout the Lower Flint River Basin.
• The project will also monitor aquifer health and support regional planning for instream flow management and conservation of federally listed endangered and threatened freshwater mussels in the region through the development of a Habitat Conservation Plan (HCP). A Project Advisory Board will guide implementation, make related policy recommendations, and support regional water resource planning and management.
• The Council recommends further evaluation of the feasibility of this practice and its potential impacts on groundwater aquifers in this water planning region. The Council acknowledges efforts by the state to evaluate groundwater development as an alternative water source in the past several years and looks forward to additional information to be developed on these aquifers by the new GA-FIT project. These studies provide an important base of information to support implementation of this practice.</td></tr>
<tr><td>Short-Term Actions</td><td>Long-Term Actions</td><td>Responsible Parties</td></tr>
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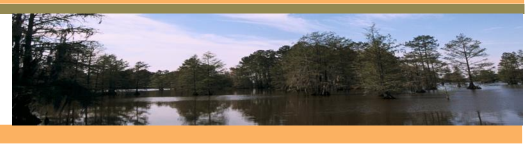
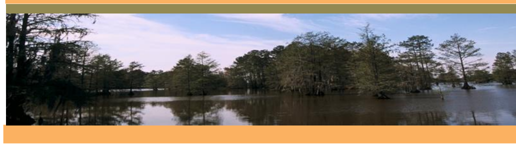


WATER MANAGEMENT PRACTICES		
Continue to evaluate the feasibility of this practice and potential impacts on aquifers Identify funding for conversion incentives	Implement if feasibility and impacts are found to be favorable Provide incentives for conversions	GAEPD GA-FIT project partners and Advisory Board University researchers Permittees
SF4: Encourage greater utilization of new or existing farm ponds in the Upper Flint Water Planning Region		
• On-farm water storage filled in periods of high flow can replace direct pumping for irrigation from surface streams or wells during drought periods. • Future permits to fill farm pond withdrawals should include low flow protection requirements similar to those required in the Flint River Basin Water Development and Conservation Plan of 2006. Future surface water withdrawal permits for farm ponds should be conditioned such that the withdrawals do not contribute to the frequency or severity of low flow conditions in their local drainage areas. • See Recommendation IN-7 in Section 6.3.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Encourage farm pond development Continue to evaluate impacts of farm ponds and incorporation of farm ponds in the surface water availability assessment Evaluate impacts of amenity ponds	Continue implementation (adjusted for assessment findings)	University researchers Agricultural irrigators GSWCC Soil and Water Conservation Districts GAEPD
Water Returns Management (RM)		
Issues Addressed	Surface water availability	
Council Goals Addressed	1, 3, 4	
RM1: Restrict the development of new municipal and industrial land application systems (LAS) for wastewater treatment		
• A preference for treatment systems that discharge to surface water over land application of wastewater supports increased return flows to the surface water. • The Council recommends that new municipal and industrial LAS be used only as an option of last resort. • Treatment by LAS currently accounts for 7 mgd or 20% of the total treated wastewater volume in the region. In Section 4.1.2, this proportion was held constant in the wastewater treatment forecast. This management practice would seek to reduce the proportion treated by LAS in the future. • The Council recommends a feasibility study on the retirement of LAS. The study should address flow restoration estimates and funding needs.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**



<table>
<tr><th colspan="3">WATER MANAGEMENT PRACTICES</th></tr>
<tr><td colspan="2">Preference for return flows via discharge as opposed to land application should be considered in new and expanding permits for wastewater treatment facilities (on-going)</td><td>Wastewater treatment facilities (existing and planned)
GAEPD</td></tr>
<tr><td colspan="3">RM2: Encourage Upper Flint River Basin water utilities to prioritize the return of water back to their basin of origin.</td></tr>
<tr><td colspan="3">• Prioritize the return of treated wastewater to the basin of origin in this region over alternative methods of treatment or inter-basin transfers (IBT). The Council also encourages full implementation of the GAEPD's rules and regulations surrounding IBT (GA Comp. R. & Regs. R. 391-3-6-.07).
• The Council also supports the evaluation of the feasibility of reversing existing IBT in the Flint River Basin and returning water to the region's surface waters. An example of such work is the Spalding County Sewer Feasibility Study by the Spalding County Water & Sewer Facilities Authority. The project aims to evaluate the feasibility of reducing reliance on septic systems for wastewater treatment through sewer connections for existing and future development via connection to the City of Griffin sewer system. The study will be on-going through August 2023.
• Recommendations to the State WP-4 and IN-12 address actions related to this management practice.</td></tr>
<tr><th>Short-Term Actions</th><th>Long-Term Actions</th><th>Responsible Parties</th></tr>
<tr><td colspan="2">Preference for return of treated wastewater to basin of origin should be considered in new and expanding permits for water municipal and industrial water withdrawals and wastewater treatment facilities (on-going)</td><td>Water and wastewater facilities (existing and planned)
GAEPD</td></tr>
<tr><th colspan="3">Water Quality (WQ)</th></tr>
<tr><td>Issues Addressed</td><td colspan="2">Point and nonpoint source water pollution</td></tr>
<tr><td>Council Goals Addressed</td><td colspan="2">1, 2, 3, 5, 6</td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td colspan="3">WQ1: Improve enforcement of existing permits and regulations and implementation of existing plans and practices</td></tr>
<tr><td colspan="3">Increase technical assistance from GAEPD to local communities for improved education and improved enforcement of erosion and sediment control, such as assistance for small communities to become a Local Issuing Authority (LIA).</td></tr>
<tr><th>Short-Term Actions</th><th>Long-Term Actions</th><th>Responsible Parties</th></tr>
<tr><td>Implement GAEPD training for local erosion and sediment control programs by next planning cycle (five years)
Continue implementation of programs and plans</td><td>Continue implementation of programs and plans</td><td>GAEPD
GSWCC
Local governments</td></tr>
<tr><td colspan="3">WQ2: Improve implementation of nonpoint source controls</td></tr>
<tr><td colspan="3">The Council recommends the following:
• Encourage use of the Georgia Stormwater Management Manual or alternative equivalent stormwater management throughout this water planning region.
• Promote and implement best management practices throughout this water planning region for all industries. Encourage the implementation of BMPs, such as public education and involvement, illicit discharge detection and elimination, construction and post-construction activities, pollution prevention, and good housekeeping.
• Continue support of local governments and authorities in the development of stormwater utilities as a funding mechanism for the</td></tr>
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WATER MANAGEMENT PRACTICES

implementation of nonpoint source control measures.

- Encourage agricultural landowners to participate in the NRCS programs such as the Conservation Stewardship Program and to complete farm conservation plans, which may include on-farm nutrient management and waste disposal management plan.
- Encourage use of wastewater treatment systems with point source discharges where practicable and consider additional land application systems discharges only as a last resort (see Management Practice RM1).
- Encourage local communities to increase stream buffer quality in this water planning region.
- Create a conservation land program that targets voluntary acquisition of stream buffers for water quality.
- Evaluate existing amenity ponds as a water quality management tool.
- Encourage implementation of stream buffers to improve water quality in this water planning region for all land uses. Incentive programs can support better implementation, improved buffer quality, and addition of buffers in existing development. The Council recommends increased funding for Section 319 grants to support nonpoint source control projects.
- Encourage increased wildlife management to control invasive and nuisance species that impact water quality, specifically feral hogs.

Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Adopt Revised Georgia Stormwater management manual or alternative equivalent stormwater management (local governments, on-going) Design and develop a regional land conservation program directed at stream buffers by the next planning cycle (five years) Continue implementation of existing non-point source control programs (on-going)	Continue implementation of Continue implementation of existing programs (on-going) programs and plans	GSWCC Georgia Land Conservation Program Local governments NRCS Soil and Water Conservation Districts Farmers Foresters Georgia Forestry Commission GAEPD

WQ3: Increase education directed toward improving water quality

WATER MANAGEMENT PRACTICES

- Improve education of local governments, industries, schools, and individuals regarding the impact of activities on water quality in this water planning region through multiple activities such as training courses for government staff and leaders focused on water quality and periodic water summits to highlight the water quality impacts challenges, and solutions shared by separate government agencies.
- Establish a speakers' bureau that coordinates with the Association County Commissioners of Georgia, the Georgia Municipal Association, the Georgia Association of Water Professionals, the American Water Works Association, the Georgia Rural Water Association, and Regional Commissions to assist in educating local communities.
- Encourage increased education about and implementation of best management practices for dirt road maintenance as outlined in the Georgia Better Back Roads Field Manual.
- Encourage education about groundwater quality for agricultural and residential wells and the availability of existing programs for homeowners with wells such as those offered by the Golden Triangle Resource Conservation and Development Council.
- Support education to local governments about water quality regulations and permitting, especially as it relates to different water/wastewater sectors.
- Support education concerning proper pharmaceutical disposal in the community and the utilization of existing educational resources such as information from the Metro North Georgia Clean Water Campaign (Medicine Disposal - Clean Water Campaign) and guidance from the Georgia State Attorney Generals (Disposal of Rx Drugs | Office of Attorney General of Georgia Chris Carr).

Short-Term Actions	Long-Term Actions	Responsible Parties
Establish a speakers' bureau to assist in educating local communities by next planning cycle Increase awareness and education related to Better Back Roads Field Manual Continue implementation of public education programs regarding water quality	Continue implementation (on-going)	GAEPD GSWCC Local Governments Association of County Commissioners of Georgia Georgia Municipal Association American Water Works Association Georgia Association of Water Professionals Georgia Rural Water Association Regional Commissions

WQ4: Improve water quality monitoring and assessment

- Water quality monitoring has expanded and supported better understanding of water quality conditions in this water planning region.
- Continue to improve the information base on water quality conditions to support improved resource assessment in the future.
- Fund and conduct a study of low flow conditions in the Flint River Basin to assess instream health and water quality and develop flow curve characterizations.
- Evaluate the feasibility, benefits, and costs of augmentation and flow restoration as it pertains to water quality.
- Promote additional studies that build on existing work related to drought, drought triggers and potential actions needed to maintain water quality in the Flint River Basin in dry periods.
- Increase sampling sites in the riverine portion of the basin and parameters sampled at each sampling location as needed to improve water quality database and future assessments. Ensure regular (monthly) data collection from USGS flow gages in the mainstem and tributaries. Monitor metals and hydrocarbons, as well as nutrients and sediments. Include more wet weather samples to support evaluation of nonpoint source impacts.
- Document ongoing water quality assessment activities and water quality practice implementation.
- Encourage DNA studies in impaired stream reaches to identify and target sources of fecal coliform and document stream reach

WATER MANAGEMENT PRACTICES		
classification using E. *coli water quality standard*.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Continue to implement water quality monitoring in the region to support water planning and resource assessments (on-going)		GAEPD Local governments and water and wastewater systems
WQ5: Utilize technology to improve water quality management information		
• Use technology tools to identify water quality areas of concern, such as geographic information systems (GIS), satellite imagery, and data collection drones. • Coordinate water quality monitoring required by GAEPD and utilize data from Georgia Environmental Monitoring and Assessment System (GOMAS), Adopt-a-Stream, and USGS. • Encourage collection and submittal of water quality monitoring information to a single database, such as the Georgia Environmental Monitoring and Assessment System (GOMAS). • Encourage agencies (local, regional, and state) to utilize this information to improve water quality outcome of existing programs.		
Short-Term Actions	**Long-Term Actions**	**Responsible Parties**
Evaluate and adopt (as appropriate) new technology for water quality monitoring (on-going)		GAEPD Water withdrawal and wastewater treatment permittees University researchers

The Upper Flint Water Planning Council selected these management practices to apply to the whole Upper Flint Water Planning Region. Although the water planning region's boundaries encompass multiple surface water and groundwater resources, the Council believes that the management practices will benefit all of these resources. The selected management practices were adopted by the Council because they address potential water resource management challenges identified through evaluation of the resource capacities and regional needs, discussed in Sections 3, 4, and 5. The practices were also selected to fulfill the Council's vision and goals for this water planning region (see Section 1.3).

The resource assessments are designed to help the regional water planning councils identify areas where management practices might be needed to ensure that region's water resources can sustainably meet long-term demands for multiple uses. The resource assessments are designed to be highly conservative in identifying potential impacts. The Council recognizes both the value and the limitations of the resource assessment models and relies on them as one input for guidance in planning.

Water conservation is a top priority management practice in this Regional Water Plan. The Upper Flint Water Planning Council recognizes that water users have already invested in and implemented a substantial portfolio of conservation practices in this water planning region. Their prior conservation efforts should be taken into account and given credit toward compliance in the design of conservation programs and policies. (See Recommendation WP-3 in Section 6.3.)

Water quality is another priority for the Upper Flint Water Planning Council. The Council recognizes that a large investment has been made in the region in Best Management Practices that have been implemented by municipalities, agriculture, forestry, and industry to protect and improve water quality. These prior efforts should be taken into account and considered when assessing compliance or developing incentives in water quality programs and policies.

The Upper Flint Water Planning Council recognizes that water resource planning should follow an integrated approach. Planning must consider the full range of water needs on a basinwide scale and consider and address how water quantity and quality management are directly linked and interdependent. For example, flow levels affect water quality conditions, and wastewater treatment methods have important implications for return flows. The integrated nature of water resource management means that many of the Council's management practices have important implications for both water quantity and quality in this water planning region's water systems. These interdependencies were considered by the Council in plan development and should be considered in implementation of this Plan.

As the regional water planning process evolves, the Upper Flint Water Planning Council recommends the development of more precise measures of the health of its water resources. This recommendation is explored further in Section 6.3.

6.3 Recommendations to the State

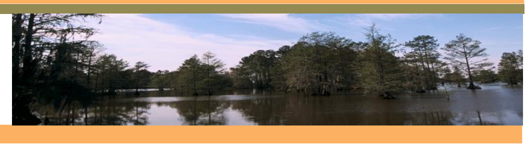
In addition to the management practices described in Section 6.2, the Upper Flint Water Planning Council makes the following recommendations that seek to improve water resource management and planning in this water planning region and the State as a whole.

Information Needs

Addressing the following information needs would support improved water resources management and future water planning. Implementation of research and assessments to fill these information needs will require funding (state, federal, other). In general, implementing actors are not indicated here; if funding is identified, qualified researchers from state universities, institutions, and agencies, as well as private sector firms, can fulfill these information needs. As new information becomes available, it should be incorporated into future cycles of the regional water planning process, and the resource assessment models should be modified to reflect up-to-date information as it is developed.

IN-1: Improve resource assessment models used in the regional water planning process through increased use of actual water use and resource conditions data. The incorporation of agricultural water meter data in the forecasts and resource assessments was a notable improvement in the previous planning cycle. The Upper Flint Water Planning Council urges continued adoption of actual data, where possible. The Council recommends expanded use of data collected by local governments and water and wastewater systems in the region in the forecasts and resource assessments.

IN-2: Improve estimates and forecasts of water use by the energy sector to support regional water planning in Georgia. GAEPD develops energy water use forecasts for regional water planning, but the forecasts do not identify geographically specific water needs. The Upper Flint



Water Planning Council recommends additional efforts to understand future water use by the energy sector in this water planning region. Energy water use forecasting should also account for greater cooling tower efficiencies, energy conservation, future increases in power production, water quality, and other factors, as appropriate.

IN-3: Georgia, Florida, Alabama, and the USACE should commit to continued and coordinated review and improvement of the Unimpaired Flows dataset for the ACF System. Where technically feasible, refinement of the Unimpaired Flows dataset should include impacts from land use change as well as water withdrawals, returns, net evaporation or other human influences.

IN-4: Improve assessment of groundwater use and recharge to support better understanding of impacts of use on aquifers and streamflow and protection for aquifer recharge areas. The Upper Flint Water Planning Council recognizes improvements to assess groundwater availability, and it urges continued efforts to improve our understanding of aquifer health.

IN-5: Evaluate the costs and benefits of reducing the minimum threshold at which permits are required for water withdrawals (surface water and groundwater). This assessment would be supported by estimation of the amount withdrawn by small, unpermitted withdrawals (<100,000 gallons per day).

IN-6: Complete a comprehensive assessment of baseline implementation of water conservation and water quality Best Management Practices by agricultural producers. The Council recognizes that state and federal agencies have existing programs that measure BMP implementation, but at this time, a comprehensive baseline assessment is lacking. Field verification of conservation equipment adoption by farmers in the Lower Flint River Basin has initiated development of a baseline dataset. The Council recommends that this survey be expanded to include the entire Flint River Basin. A comprehensive field survey of BMP implementation, for conservation and water quality practices would support estimation of potential benefits of future implementation, tracking of implementation progress, and BMP prioritization. The survey periodically conducted by the Georgia Forestry Commission (GFC) on BMP implementation is a model for a program to address this information need.[4]

IN-7: Evaluate the full water cycle impacts of irrigation and the impacts of small and medium impoundments on stream flows through intercepted drainage, evaporative loss, and water quality. GAEPD has advanced the understanding of how farm ponds are used in Georgia. However, better understanding of farm pond operation and impacts is needed to support more thorough evaluation. In particular, a better understanding of the impact of evaporative loss is

[4] Water quality programs for nonpoint source management in the forestry industry are a potential model for other sectors. Georgia's Best Management Practices for Forestry (https://gatrees.org/wp-content/uploads/2020/02/BMP-Manual-2019-Web.pdf) describes benchmark BMP guidelines for Streamside Management Zones, Forest Roads, Stream Crossings, Timber Harvesting, Site Preparation, Reforestation, Special Management Areas and all other forestry related practices. The Georgia Forestry Commission conducts a biennial statewide BMP implementation survey in accordance with the Southern Group of State Foresters protocol. Randomly selected forestry operations are selected statewide and evaluated for appropriate BMP implementation. For the 2021 BMP Implementation Survey, the GFC evaluated 260 sites totaling 50,421 acres statewide. Forestry BMPs were properly implemented at a rate of 92.6%.

needed.

IN-8: Conduct a dynamic analysis (under varied management, development, and climatic conditions in the region) to assess how conservation can optimize use of reservoir storage. Consider the results of this analysis when implementing Management Practice SF1 regarding the evaluation of water storage options in the Upper Flint Basin.

IN-9: Continue to improve data on agriculture water use through continued implementation of the agricultural water withdrawal metering program administered by Georgia Environmental Protection Division. See Management Practice DM1

IN-10: Evaluate implementation and effectiveness of water conservation practices. Periodically, it will be important to assess the progress and benefit of the water conservation program.

IN-11: Evaluate the use designations assigned to stream reaches in the Upper Flint Water Planning Region as a part of the Triennial Review of Georgia Water Quality Standards. This review is intended to ensure that water quality performance criteria reflect actual conditions, in terms of both use and quality.

IN-12: Conduct a feasibility assessment of interventions that would improve flows in the Upper Flint River Basin. Evaluate each option with respect to costs, expected flow benefits, implementation barriers, and other factors that would affect the likelihood of success. The following potential interventions should be included in the feasibility assessment:

- Convert land application systems (municipal & industrial) in the upper basin to direct discharge
- Establish greater storage capacity in the upper basin
- Reverse inter-basin transfers
- Convert existing septic systems to sewer
- Guide future development to sewer instead of septic
- Changes in reservoir management by upper basin utilities

The Council notes that these are not recommended interventions at this time but rather a set of potential options. Additional information on these options may support policy and planning that can effectively address flow restoration in the upper part of the Flint River Basin. The Council intends to track such information about these options as it becomes available and incorporate it into their future planning efforts.

Information about the feasibility of these options is currently being developed in new studies in the region. The Council wishes to highlight the Spalding County Sewer Feasibility Study by Spalding County Water & Sewage Facilities Authority as an example of a project that will help with the implementation of this recommendation. The study evaluates the feasibility of reducing reliance on septic systems in the county through connection to the City of Griffin sewer system. The study will be on-going through August 2023. The Council addresses related concerns in Management Practice RM-2 for the Council's recommendation addressing prioritization of returning treated wastewater to the basin of origin.

Additionally, a new seed grant project, funded in early 2023 and led by the University of Georgia, will develop information on potential benefits of these types of interventions for upper basin flows. The Council supported the proposal for this seed grant and plans to provide input to the project as it is implemented.

Water Policy Recommendations

In the following recommendations, the Upper Flint Water Planning Council urges the Georgia General Assembly and other policymakers (e.g., Board of Natural Resources) to pursue actions to improve water resource management in the state and in the Upper Flint Water Planning Region.

WP-1: The Council recommends that the Georgia General Assembly provide funding for continued planning by the regional water planning councils, as described in Section 14 of the State Water Plan, in order to ensure continued progress toward the vision and goals of the state and regional water plans. The Council also recommends that the General Assembly provide funding to support monitoring of plan implementation, data collection to support future planning by the regional water planning councils, and continued refinement of water resource assessments used in the development of Regional Water Plans.

WP-2: The Council recommends that the Georgia General Assembly and implementing agencies, such as GAEPD, explore all possible funding sources to offset or pay for many of the management practices outlined in this Plan. The Council emphasizes that funding for plan implementation is the Council's highest priority. Financial incentives and reimbursement for implementation of practices will expedite the progress needed to achieve the goals of this Plan.

WP-3: The Council recommends that GAEPD and other agencies with water policy responsibilities should design water conservation policy and regulations to recognize and credit water users for conservation practices that they have already implemented. Conservation policies and regulations should prioritize addressing consumptive over nonconsumptive uses. Additionally, conservation policy and regulations should be designed with an emphasis on cost-effectiveness as a key criterion.

WP-4: The Council urges the Georgia General Assembly and other state policymakers not to preclude interbasin transfer (IBT) as an option for future water management in the region, as needed and following thorough scientific and economic evaluation. Many IBTs of water exist in Georgia at this time. The Council recognizes that IBT (existing or future) can play an important role in water resource management. They can provide supply or flows to a receiving basin where water is needed. Rules adopted by the Georgia Board of Natural Resources in January 2011 will help to ensure that future permits for IBTs are thoroughly evaluated.[5] The Council also supports the evaluation of the feasibility of reversing existing IBTs in the Flint River Basin and r

[5] See DNR Rules Chapter 391-3-6-.07.

eturning water to the region's surface waters. On a case-by-case basis, additional scientific research is necessary to determine the costs and effects to water and wastewater service providers for modifying facilities, estimate the return flow benefit to the basin of origin, and identify sources for funding to reverse IBTs. An example of such research is available in a report prepared for the City of Griffin by the Paragon Consulting Group (*Technical Memorandum: Flint River Basin/Ocmulgee River Basin Interbasin Transfer Analysis*, 2016). This report estimates the costs and flow benefits for IBT reversal for the City of Griffin's utilities.[6]

WP-5: The Council supports implementation of the voluntary irrigation suspension auction provided for by the Flint River Drought Protection Act (OCGA §12-5-40), when absolutely necessary in abnormally dry periods and when other options are not available to address severe flow depletions during the growing season. When possible, GAEPD should provide notification of use of the Flint River Drought Protection Act before the March 1 drought declaration deadline. Earlier notification to farmers would inform planting decisions and help reduce the cost to farmers and to the state for irrigation suspension. Voluntary irrigation suspension is a temporary intervention to be targeted to the period of a growing season (or less, if possible). The Council acknowledges efforts to improve drought prediction tools to support earlier notification and supports GAEPD efforts to develop better predictive tools. The Flint River Drought Protection Act has not had a predictable source of funding in recent years, and a clear and reliable source of funding is needed. The Council also supports efforts by GA-FIT to develop and test new incentives for voluntary irrigation suspension in the Flint River Basin as a tool for drought response.

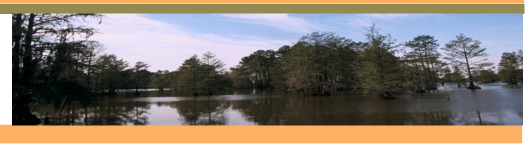
WP-6: The Council recommends that the Georgia General Assembly should attain consistent regulatory definition of stream buffers among the different land uses and managing regulatory sectors within the state of Georgia to ensure consistent application throughout the State (see Management Practice WQ-2).

WP-7: The Council recommends continued coordination and cooperation among neighboring water planning councils. The Upper Flint Water Planning Council has worked closely with the Middle Chattahoochee and Lower Flint-Ochlockonee Water Planning Councils and the Metropolitan North Georgia Water Planning District. Our joint efforts will benefit our regions and the State as a whole.

Coordinated Recommendations with Neighboring Councils

Since the beginning of regional water planning in Georgia in 2009, the Upper Flint Water Planning Council has ensured coordinated with neighboring regional water planning councils to discuss shared water resources and topics of concern. The Upper Flint Water Planning Council has met several times with the Lower Flint-Ochlockonee and Middle Chattahoochee Water Planning Councils and developed a collaboration with these councils that led to their agreement on a set of joint recommendations in 2011, with revisions jointly adopted in 2017. In this

[6] This report estimates that reversing the IBT at Griffin's Cabin Creek Wastewater Treatment Plant would cost approximately $6 million and provide a return flow benefit of approximately 0.75 mgd.



planning cycle, the three councils reviewed and revised their joint recommendations again. In 2022, the following joint recommendations were approved by all three councils. The agreement among these councils on these recommendations indicates the importance of these recommendations to the Apalachicola-Chattahoochee-Flint Basin, of which all three councils are a part, and to the State as a whole.

These joint recommendations overlap with some of the Upper Flint Water Planning Council's management practices and recommendations. Where overlap does occur, the Council does not see any conflict; the Council's management practices and recommendations generally provide more detail than the joint recommendations. In all cases, the Council's Regional Water Plan takes precedence over the joint recommendations.

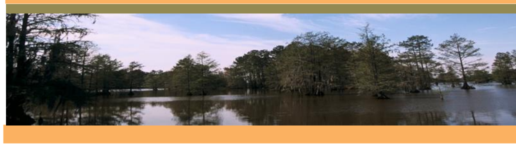
The Upper Flint, Lower Flint-Ochlockonee, and Middle Chattahoochee Water Planning Councils:

JT-1: Recognize the critical need for better use of existing storage and more storage in the Apalachicola-Chattahoochee-Flint System and recommend that a plan for additional storage is developed and implemented and that it considers the following: better utilization of existing storage in the Chattahoochee River Basin, new storage in the Flint River Basin, and enhancement of existing storage capacity.

JT-2: Urge GAEPD and those involved in the resource assessment modeling to continue to improve existing models for future regional water planning by further expanding the use of actual and current data on water use and conditions and refining modeling assumptions to more closely approximate actual conditions.

JT-3: Recommend proactive engagement among Georgia, Alabama, and Florida to collaborate on opportunities to improve planning for shared water resources in the ACF Basin.

JT-4: Recognize the need for identifying contributors that diminish water quality. Continue to develop methods, guidelines, and BMPs to improve water quality and continue to educate on these BMPs.



SUMMARY: This section presents the Upper Flint Water Planning Council's roadmap for the implementation of the water management practices identified in Section 6. Implementation actions and responsible parties are described, and schedules are specified, where appropriate. The Council's research and policy recommendations are also included in this section.

Section 7. Implementing Water Management Practices

This section presents the Council's roadmap for the implementation of the water management practices identified in Section 6. It details schedules for implementation and responsible parties for implementation. It also describes the alignment of this Regional Water Plan with other plans that address or relate to water resources in this water planning region. It ends with recommendations from the Council related to information needed to improve future planning and water policy changes that would facilitate attainment of the Council's vision and goals for the Upper Flint Water Planning Region.

The availability of funding is a critical determinant in the ability of the responsible parties to successfully implement the management practices identified in this Plan. In general, sources of funding for individuals, such as farmers, include investment by these individuals and grant and incentive programs. Sources of funding for implementing management practices at the local government or utility level include revenues generated by water and wastewater providers, local government general funds raised through property taxes, and service fees charged by local governments to citizens. Local governments and utilities can also apply for loans and grants to finance implementation. Affected authorities and individuals in this water planning region will be responsible for determining the best method for funding and implementing applicable management practices.

7.1 Fiscal Implications of Selected Water Management Practices

Table 7-1 provides planning-level guidance for implementation of the management practices in this Regional Water Plan as provided in Table 6-1. Current funding guidance has not been included as development of cost estimates for these management practices are variable and dependent on several factors including scope of work, market conditions, technological improvements and availability of supplies, equipment, and labor. GAEPD developed a "Supplemental Guidance for Planning Contractors: Water Management Practice Cost Comparison", last revised in April 2011, that provides guidance about the relative costs of various water management practices (WMPs).[1]

[1] Supplemental Guidance for Planning Contractors: Water Management Practice Cost Comparison, Revised April 2011 provided in Regional Water Planning Guidance: https://waterplanning.georgia.gov/document/publication/cost-guidance/download

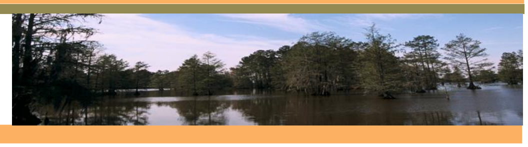
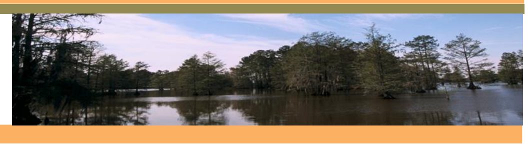


Table 7-1: Cost Considerations for Implementation Responsibilities

Management Practice	Potential Funding Sources	Notes and Sources
DEMAND MANAGEMENT (DM)		
Issues Addressed	***Surface and groundwater water availability***	
Council Goals Addressed	***1, 3, 4, 5, 6***	
DM1: *Maintain the agricultural water withdrawal metering program* ****HIGH PRIORITY** MANAGEMENT PRACTICE**	Georgia General Assembly	Meters were provided by the State to withdrawal permittees with permits as of July 1, 2003. After that date, new permittees must purchase own meter.
DM2: *Implement non-farm water conservation practices in the Upper Flint Water Planning Region*	State agencies Water and wastewater revenues Individuals as required by law	Lower cost WMPs are forresidential water audits, leak response, training, rate structure modifications. Higher cost WMPS are for rebate programs, facility upgrades, water line replacement, water reuse, and programs targeting high water users.b
DM3: *Encourage all water providers to implement education and outreach programs*	State agencies Water and wastewater revenues	Lower cost WMPs include education, audits, rain sensor shutoffs Higher cost WMPs include: rebate programs, facility upgrades, water line replacement, water reuse, and programs targeting high water usersb
DM4: *Implement agricultural water conservation practices in the Upper Flint Water Planning Region* ***DM5:*** *Implement voluntary agricultural water conservation practices in the Upper Flint Water Planning Region with the support of incentive programs*	Individual investment Incentive programs (GSWCC; Soil and Water Conservation Districts; NRCS, USDA)	Lower cost WMPs include sod-based rotation with conservation tillage. Higher cost WMPs includevariable rate irrigation.
DM6: *Manage agricultural water withdrawal permits in the Flint River Basin according to state regulations based on the 2006 Flint River Basin Water Development and Conservation Plan and other applicable state regulations and policy.*	GAEPD	Withdrawal permits issued after the 2006 Flint Plan have a $250 application fee.
DM7: *Create an awards program to recognize agricultural irrigators for exemplary implementation of best management practices (BMPs) for water conservation*	Georgia General Assembly Private donations	
SUPPLY MANAGEMENT AND FLOW AUGMENTATION (SF)		
Issues Addressed	***Surface water and groundwater availability***	

Management Practice	Potential Funding Sources	Notes and Sources
Council Goals Addressed	***1, 2, 3, 4, 5***	
SF1: *Evaluate storage options in the Upper Flint River Basin that can provide for supply and flow augmentation in dry periods* *****HIGH PRIORITY** MANAGEMENT PRACTICE***	Municipal or industrial capital investment State and federal funding Private investment Water/wastewater revenues GEFA loans	Evaluation will include costs for (but not limited to): development of yield and performance criteria; site selection; property assessments and appraisals; and definition of permit requirements. Reservoir cost is dependent on land value and costs of construction materials. Additional costs could include piping, land acquisition, permitting, conveyance, and treatment .
SF2: *Evaluate streamflow augmentation via direct pumping from aquifers to mitigate adverse impacts to in-stream flows in dry periods*	Federal or state agencies	Costs will need to include well costs and land acquisition. Costs are dependent on well depth, soil conditions, pipe size and distance, and number of pump stations. Cost could include piping and treatment for municipal supply wells. Costs of wells for irrigation, which does not require treatment, may be less.b
SF3: *Develop groundwater source alternatives to replace surface water withdrawals during drought, where feasible*	Individual investment Incentive programs (GSWCC, Soil and Water Conservation Districts, NRCS, GA-FIT) GEFA State agencies	See comments for SF2 above.
SF4: *Encourage greater utilization of new or existing farm ponds in the Upper Flint Water Planning Region*	Individual investment Prior incentive programs no longer available	Farm pond costs to evaluate include earth excavation and grading, pumping and piping costs.
WATER RETURNS MANAGEMENT (RM)		
Issues Addressed	***Surface water availability***	
Council Goals Addressed	***1, 3, 4***	
RM1: *Restrict the development of new land application systems for wastewater treatment*	Costs for treatment systems for point source discharges may differ from land application systems	
RM2: *Encourage Upper Flint River Basin water utilities to prioritize the return of water back to their basin of origin.*	Facilities to return water to basin of origin may involve additional utility capital, operations, and maintenance costs	



Management Practice	Potential Funding Sources	Notes and Sources
WATER QUALITY (WQ)		
Issues Addressed	***Point and nonpoint source water pollution***	
Council Goals Addressed	***1, 2, 3, 4, 5, 6***	
WQ1: *Improve enforcement of existing permits and regulations and implementation of existing plans and practices*	State and federal agencies Permit fees	Need to evaluate whether implementation and enforcement can be improved without additional expenditures. Costs could include (but not limited to): site visits, training, and enhanced tools and practices.
WQ2: *Improve implementation of nonpoint source controls*	NRCS Soil and Water Conservation Districts 319(h) grants Other state and federal funding and incentive programs Private investment	Costs could include (but not limited to): WMP installation and maintenance; public education; new ordinances[c]
WQ3: *Increase education directed toward improving water quality* ****HIGH PRIORITY** MANAGEMENT PRACTICE**	State and federal funding and incentive programs Water and wastewater rates Local government general funds Stormwater utility fees	Lower cost: print materials; website Higher cost: mass media
WQ4: *Improve water quality monitoring*	State agencies Wastewater rates Stormwater utility fees	Grab sampling includes monitoring chemical water quality annually for fecal coliform bacteria and traditional stormwater parameters (no metals). Habitat and benthos monitoring includes monitoring biological water quality annually through assessment of habitat and macroinvertebrate populations.b
WQ5: *Utilize technology to improve water quality management information*	State agencies Water and wastewater revenues Stormwater utility fees	
Notes and Sources: a. Programmatic costs will vary widely depending on the specific actions selected. Further study and data are needed to refine the evaluation of costs and benefits of selected practices.. All values should be viewed as planning level numbers that can be updated through further study and data collection regarding the level of baseline implementation already in place and the corresponding benefits achieved b. Source: GAEPD. Supplemental Guidance for Regional Planning Contractors: Water Management Practice Cost Comparison, Revised April 2011. Available on the state water planning website.		

7.2 Alignment with Other Plans

The development of this Plan by the Council builds upon a knowledge base developed in previous planning efforts by state and local governments and authorities. In the last planning cycle, the Council conducted a comprehensive review of existing local and regional plans and relevant related documents that concern water resources to frame the selection of management practices.

The Council also ensured alignment with other Regional Water Plans by coordinating with neighboring water planning councils and the Metropolitan North Georgia Water Planning District. The Council participated in a joint meeting with several other water planning councils, including the Lower Flint-Ochlockonee and Middle Chattahoochee Water Planning Councils. In this meeting, council members discussed shared issues relating to resource availability and quality and policy, regulatory, and funding issues.

The Council included joint recommendations with the Lower Flint-Ochlockonee and Middle Chattahoochee Water Planning Councils in its 2011 and 2017 plans, and this revised plan updates the joint recommendations (see Section 6.3). The Council coordinated with these neighboring water planning councils with the support of the planning contractor to align the joint recommendations. Additionally, the Council reviewed the draft water resources plan of the Metropolitan North Georgia Water Planning District and submitted comments to the District on the draft plan in May 2022. Through these efforts, the Council has coordinated its Plan with the plans of neighboring water planning councils and the Metropolitan North Georgia Water Planning District. No conflicts with these other regional water plans have been identified.

7.3 Benchmarks

The benchmarks listed in Table 7-2 below will be used to assess the effectiveness of this Regional Water Plan's implementation and identify where revisions are needed. The Council selected both qualitative and quantitative benchmarks that will be used to assess whether the Plan's management practices address potential gaps identified by the resource assessment models between resource capacity and demand over time and whether the Council's vision and goals are being met (or progress is being made toward attainment). The benchmarks will be used to evaluate the effectiveness of this Plan at the next five-year plan review.

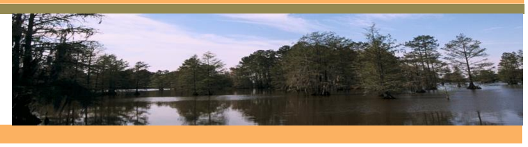
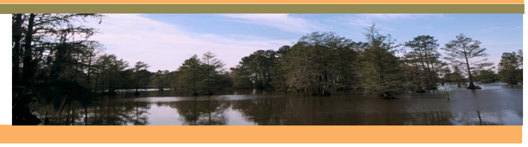


Table 7-2: Benchmarks for Upper Flint Regional Water Plan

Management Practice	Benchmark	Measurement Tools	Time Period
All Management Practices	Revised resource assessments	Quantify the impacts of implemented management practices on potential gaps identified by the resource assessment models for the Flint, Ochlockonee, Suwannee River Basins, the Upper Floridan Aquifer in the Dougherty Plain, and the Claiborne Aquifer	Next planning cycle (five years)
DEMAND MANAGEMENT (DM)			
Issues Addressed	***Surface water and groundwater availability***		
Council Goals Addressed	***1, 3, 4, 5, 6***		
All Demand Management Practices (DM1 through DM7)	Per capita water use (non-farm); agricultural water use (note that interpretation requires adjustment for climate and crops)	Updated per capita use estimates for next iteration of the Regional Water Plan; agricultural water meter readings	Per capita water use: next planning cycle (five years); agricultural meter readings: annual
DM1	Complete meter installations as soon as possible (statutory deadline was July 2009)	Evaluate meter installations against number of permitted withdrawals; annual meter program summary report	Annual
DM2	Compliance with permit requirements	Progress reporting required for permittees	Annual
DM4 and DM5	Compliance with permit requirements and efficiency requirements of OCGA § 12-5-546.1; additional Council defined efficiency benchmarks: • All irrigation systems will have application efficiency of 90% or greater by January 2050; • 50% of farmers using irrigation will adopt irrigation scheduling by January 2020	Permit enforcement actions; incentive program implementation reporting; NRCS/ Extension agent estimates of implementation; continued and expanded survey of baseline implementation with updates	Enforcement actions: on-going; practice implementation: summary report for next planning cycle (five years)

Management Practice	Benchmark	Measurement Tools	Time Period
SUPPLY MANAGEMENT AND FLOW AUGMENTATION (SF)			
Issues Addressed	***Surface water availability; groundwater sustainable yields***		
Council Goals Addressed	***1, 2, 3, 4, 5***		
All Supply Management and Flow Augmentation Practices ***(SF1 through SF4)***	Implementation of management practices	Perform regional survey to quantify implementation; gather details regarding implementation challenges and roadblocks where applicable	Next planning cycle (five years)
SF1	Completion of feasibility evaluation; implementation of recommendations	Feasibility evaluation; reservoir permitting, construction, and improvement	Feasibility evaluation report by next planning cycle (five years)
SF3	Number of surface water withdrawal conversions to groundwater withdrawals; evaluation of groundwater impacts; continued assessment of Claiborne Aquifer capacity to support this practice; cost estimates for conversions	Permit conversion records (GAEPD); groundwater availability resource assessment for next regional water planning cycle	Next planning cycle (five years)
WATER RETURNS MANAGEMENT (RM)			
Issues Addressed	***Surface water availability***		
Council Goals Addressed	***1, 3, 4***		
RM1 and RM2	Limited or no construction of new land application systems or septic tanks and reduction of interbasin transfers in this water planning region	Number of new land application system permits in this water planning region (GAEPD); volume of wastewater treated by LAS in this water planning region	On-going; update to estimate of volume treated estimate for next planning cycle
WATER QUALITY (WQ)			
Issues Addressed	***Point and nonpoint source water pollution***		
Council Goals Addressed	***1, 2, 3, 5, 6***		
All Water Quality Management Practices (WQ1 through WQ5)	Implementation of recommended management practices	Perform regional survey to determine the level of implementation; survey to gather details regarding implementation challenges and roadblocks where applicable	Next planning cycle (five years)



Management Practice	Benchmark	Measurement Tools	Time Period
WQ1, WQ2, and WQ3	De-listing of impaired streams	303d/305b report	Biennial for impaired streams listing
WQ4	Continued availability of monitoring results that can be used in planning	GAEPD status update on monitoring data available for resource assessments; available monitoring data[2]	Next planning cycle (five years)

7.4 Plan Updates

Meeting current and future water needs will require periodic review and revision of this Regional Water Plan. The State Water Plan and associated rules provide that each Regional Water Plan will be subject to review by the appropriate regional Water Planning Council every five years and in accordance with this guidance provided by the Director of GAEPD, unless otherwise required by the Director for earlier review. These reviews and updates will allow an opportunity to adapt this Regional Water Plan based on changed circumstances and new information arising in the five years after adoption of this Plan by the Council and the GAEPD Director.

7.5 Plan Amendments

Amendments to this Regional Water Plan may be necessary as water resource policy conditions change in the Upper Flint Water Planning Region. Potential circumstances that may also affect implementation include amendments to the list of endangered species and critical habitats, and implementation of water quality restrictions. The Council intends that this Plan will be modified as necessary to address significant changes in this water planning region.

7.6 Conclusion

In this Regional Water Plan, the Council makes its recommendations to provide for a sustainable future for the Upper Flint Water Planning Region. While developing this Plan, the Council also identified many information and water policy needs to support improved water resources planning and management in the future. The Council urges policy makers to act on its recommendations.

The Council sees this work as a starting point. The Council emphasizes the need for continued regional water planning to ensure that the water resources of the Upper Flint Water Planning Region and the State as a whole are managed in a sustainable manner that supports public health, natural ecosystems, and the economy and enhances the quality of life for all citizens.

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[2] EPD maintains a website with monitoring data and descriptions of monitoring programs: http://epd.georgia.gov/monitoring